

Tilburg University

Big Data and Democracy

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Publication date:
2020

Document Version
Early version, also known as pre-print

[Link to publication in Tilburg University Research Portal](#)

Citation for published version (APA):
van Gils, F., Müller, W., & Prüfer, J. (2020). *Big Data and Democracy*. (CentER Discussion Paper; Vol. 2020-011). CentER, Center for Economic Research.

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Discussion paper

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17 March 2020

TILEC Discussion Paper No. 2020-003
CentER Discussion Paper No. 2020-011

ISSN 2213-9532
ISSN 2213-9419
<https://ssrn.com/abstract=3556512>

Big Data and Democracy*

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March 17, 2020

Abstract

Recent technological developments have raised concerns about threats to democracy because of their potential to distort election outcomes: (a) data-driven voter research enabling political microtargeting, and (b) growing news consumption via social media and news aggregators that obfuscate the origin of news items, leading to voters' unawareness about a news sender's identity. We provide a theoretical framework in which we can analyze the effects that microtargeting by political interest groups and unawareness have on election outcomes in comparison to "conventional" news reporting. We show which voter groups suffer from which technological development, (a) or (b). While both microtargeting and unawareness have negative effects on voter welfare, we show that only unawareness can flip an election. Our model framework allows the theory-based discussion of policy proposals, such as to ban microtargeting or to require news platforms to signal the political orientation of a news item's originator.

Keywords: disinformation, interest groups, news platforms, microtargeting, voter awareness.

JEL Codes: C72, D72, D82, D83.

*We thank Stefan Behringer, Dan Bogart, Giacomo Calzolari, Rahul Deb, Mikhail Drugov, Armando Garcia Pires, Simon Hartmann, Maarten Janssen, Amedeo Piolatto, Molly Roberts, Tanya Rosenblat, Yossi Spiegel, Juha Tolvanen, seminar participants in Tilburg, Liège and St. Gallen, and conference participants at the Media Economics Workshop (Salento, 2018), the Media and Digital Economy Seminar (EUI Florence, 2019), the Workshop on Governance of Big Data and AI (Tilburg, 2019), the SIOE conference (Stockholm, 2019), the EEA Annual Congress (Manchester, 2019) and the Digital Economics Conference (Toulouse, 2020) for helpful comments on earlier drafts.

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1 Introduction

Democracy comes with many virtues. Among them are binding constraints on the power of government and respect for individual rights (Olson, 2000). The main tool to hold governments accountable in representative democracies are elections. Election outcomes that express the will of the voters depend, in turn, on the information that voters have about politically relevant events and people. Information is required for a population to form opinions about policy issues, to critically evaluate its leaders, and more generally, to secure its well-being through its own agency (Penn, 2016). The level and credibility of information voters have access to affects their trust in political leaders, institutions, election outcomes, and, hence, in the functioning of democracy itself (Almond and Verba (1963), Van der Meer (2017)). As a principal source of political information, the media is of critical importance to (democratic) societies.

However, recent developments regarding the information available *about* voters, means to provide information *to* voters, and the nature of information acquisition *by* voters have raised concerns about threats to democracy because of their alleged potential to distort election outcomes. These developments concern (a) data-driven voter research and the possibility of political microtargeting, and (b) news consumption of growing numbers of people using social media and news aggregators that obfuscate the origin of news, leading to voter unawareness about the news sender’s identity. We comment on these developments in turn.

Platforms collect vast amounts of data on users’ preferences and characteristics by tracking them on and outside of the platform and by acquiring third-party data.¹ They can infer a range of attributes from these data, most notably users’ political views (Kosinski, Stillwell, and Graepel, 2013). Some platforms also offer microtargeted advertising services, which can be used by political interest groups to tailor news to preferences and characteristics of individual voters. Microtargeting allows interest groups (or advertisers) to differentiate their news reports, which may contain disinformation, to influence voters’ beliefs in their favor in each subgroup of the electorate.²

Today algorithm-driven platforms such as social media, search engines, and news aggregators are major players in the media landscape. More than half of digital news consumers

¹For example, Facebook has access to data provided by users on the platform, data collected by tracking users’ browsing behavior, and third-party data coming from data brokers (<https://www.nytimes.com/interactive/2018/04/11/technology/facebook-sells-ads-life-details.html>).

²Facebook’s Custom Audience is a prominent example of a microtargeted advertising service. According to investigative journalism outlet ProPublica, Facebook offers a list of 29,000 user categories that ad buyers can use to determine their target audience (<https://www.propublica.org/article/facebook-doesnt-tell-users-everything-it-really-knows-about-them>). Microtargeted advertising services were used in the 2016 U.S. Presidential Election (<https://www.nytimes.com/2018/06/21/business/facebook-political-ads.html>) as well as in elections in several other countries (Great Britain. Parliament. House of Commons. Culture, Media and Sport Committee, 2018).

use an algorithm-driven platform as their main way to obtain news (Newman et al., 2019). Platforms expose users to a wide range of outlets and interest groups that differ in their ideologies and reliability of their news items (Newman et al., 2017). Users of news platforms may find it difficult to distinguish among news senders, which, arguably, leads to voters’ unawareness of a sender’s identity. Indeed, platform users demonstrate a lack of recognition of outlet identity and are less able to attribute news items to the outlets that reported them if they saw the news on a platform than if they accessed it directly (Kalogeropoulos and Newman, 2017).³ We incorporate these findings in our model by studying a condition where voters are not aware of the political position of the reporting interest group and are therefore uncertain about its incentives to report accurately.

Ideally, all political news on platforms is accurate and balanced, enabling voters to make well-informed voting decisions. In reality, however, a variety of actors spread untrustworthy content on platforms with the aim of promoting their own political goals (Tucker et al., 2018).⁴ Disinformation produced by highly partisan websites (Faris et al., 2017), false news websites (Allcott and Gentzkow, 2017), and foreign governments (Maréchal, 2017) has been disseminated on news platforms.⁵ If the electorate is led astray by disinformation, it is not clear that election outcomes reflect voters’ true preferences. This is already problematic *per se*. But even more concerning, it calls into question the legitimacy of elections and, hence, may undermine citizens’ trust in democracy.⁶

The threat to democracy by disinformation on news platforms became the subject of heated debate in the aftermath of the 2016 U.S. presidential election. Several political commentators argued that voters’ exposure to false news on social media might have been pivotal for the election outcome.⁷ Indeed, concerns about the spread of disinformation on news platforms are not without foundation. False political news stories spread more quickly

³Kalogeropoulos and Newman (2017) report that, when a news item was accessed directly on the original website, users’ recall rate of the originator’s identity in their study was 81%, as compared to 47% if the news item was accessed via social media and to 37% if accessed via a search engine.

⁴We follow the definition of Tucker et al. (2018): “Disinformation [...] is intended to be a broad category describing the types of information that one could encounter online that could possibly lead to misperceptions about the actual state of the world.” Thus, the concept is broader than blunt lies or “fake news.”

⁵One of the best known examples is the Russian “Internet Research Agency” (<https://techcrunch.com/2019/04/18/mueller-report-ira-internet-research-agency/>).

⁶According to the Pew Research Center, 64 percent of U.S. adults say fabricated news stories cause a great deal of confusion about the basic facts of current issues and events (<https://www.pewresearch.org/fact-tank/2017/10/04/key-trends-in-social-and-digital-news-media/>) and 68 percent of U.S. adults say false news undermines their confidence in the government (<https://www.journalism.org/2019/06/05/many-americans-say-made-up-news-is-a-critical-problem-that-needs-to-be-fixed/>). Moreover, 85 percent of respondents to the Eurobarometer on Fake News and Disinformation Online consider the existence of ‘fake news’ as a problem for democracy (<https://ec.europa.eu/digital-single-market/en/news/final-results-eurobarometer-fake-news-and-online-disinformation>).

⁷See for example <https://www.theguardian.com/commentisfree/2016/nov/14/fake-news-donald-trump-election-alt-right-social-media-tech-companies> and <http://nymag.com/intelligencer/2016/11/donald-trump-won-because-of-facebook.html>.

and widely than true news (Vosoughi, Roy, and Aral, 2018) and were read and believed by many voters (Allcott and Gentzkow, 2017; Guess, Nyhan, and Reifler, 2018).

Despite the widespread attention to disinformation, microtargeting, and potential user unawareness on news platforms in public debate, the academic literature is arguably lagging behind.⁸ According to our knowledge, there is only one empirical research paper that shows a causal link from politically-motivated social media use in an election (the 2016 U.S. Presidential election) to voting behavior (Liberini et al., 2018). Moreover, to the best of our knowledge there is no political or economic theory about the influence of political interest groups on voting behavior that captures the specificities of news platforms.⁹ We address this gap in the literature and ask what role microtargeting technologies and voter unawareness about the political position of a news sending interest group play for the potential to manipulate elections.

One might argue that manipulation of rational voters is unlikely, as many voters are aware of disinformation on news platforms, and few U.S. Americans report that they have a high level of trust in social media as a place to get political news.¹⁰ Assuming rational voters, is there (still) a problem? We study this case: Can rational voters’ ex-post beliefs be affected by news they receive via news platforms from ideological interest groups, such that voters make “wrong” voting decisions in equilibrium? If so, what is the bigger problem, microtargeting or voters’ unawareness about interest groups’ political positions, and why?

We incorporate these two technological key features of today’s news platforms into a game-theoretical model: platforms may (i) enable *microtargeted* matching of news to users based on users’ preferences and characteristics and (ii) *impede users’ awareness* of the original interest group that reports the news. Our model comprises two kinds of active players, an interest group and voters. The latter consume news via a news platform that disseminates political news to voters and voters can elect political parties. A binary state of the world, which is drawn from a commonly known probability distribution, objectively favors either a left-wing or a right-wing policy. On a classical left-right political spectrum, nature determines the positions of one interest group and of two political parties (who are committed to implement commonly known left- or right-wing policies, respectively, if elected). The political position of the interest group and voting costs of each voter are private information and drawn from commonly known distributions. The interest group can

⁸Lazer et al. (2018) discuss existing literature on ‘fake news’, assess that much remains unknown, and raise a number of unanswered questions about the impact of ‘fake news’.

⁹We use the term *interest group* as reference to all ideologically motivated suppliers of political content, that is, it includes traditional newspapers or TV channels but also the websites and social media accounts of political organizations and individuals. *News platforms* include but are not limited to social media, news aggregators, and search engines.

¹⁰<https://www.journalism.org/2020/01/29/an-oasis-of-bipartisanship-republicans-and-democrats-distrust-social-media-sites-for-political-and-election-news/>

send a message about the state of the world to voters who are uniformly distributed over the political spectrum. The interest group knows the state of the world but voters do not. The timing of actions is that, first, the interest group sends a message to voters about whether the state of the world is either favoring a left- or a right-leaning policy. Voters receive the message, update their beliefs about the state of the world, and then cast their vote for one of the parties, or abstain. While voters maximize expressive utility from voting, the interest group minimizes the weighted mismatch costs between its own preferred policy position and the ones of the two parties, depending on the realized state of the world.

We consider four different games, which are determined by varying the two essential features discussed above. First, the interest group must either send the same message to all voters (*public*) or can let the message depend on individual voters’ ideological position (*microtargeting*). Second, when updating beliefs, voters can either be *aware* or *unaware* of the political position of the interest group.¹¹

For each of the four games, we characterize the voter-welfare maximizing Perfect Bayesian Equilibrium, *i.e.*, the Perfect Bayesian Equilibrium with the highest voter welfare. We show that, depending on the game voters are in and on their ideological position, some voters and interest groups always prefer the same party over the other one independent of the state of the world (which we call “radicals”), whereas others change their party preferences in line with the state of the world (called “moderates”). Because radical interest groups ignore their information about the state of the world and always try to send messages that support their preferred party, in games with awareness about the sender’s position all voters ignore messages from radical groups. By contrast, we show that the messages sent by moderate interest groups can be truthful in equilibrium: those groups have an incentive to inform moderate voters truthfully as their goals are aligned. If moderate groups are constrained by public news dissemination, they inevitably also inform radical voters about the truth. However, with microtargeting that *disciplining effect* disappears and radical voters do not receive valuable information about the state of the world anymore because all types of interest groups have an incentive to manipulate their beliefs. Hence, radical voters rationally ignore all news and suffer most from microtargeting.

By contrast, the switch from awareness to unawareness of voters about the ideological position of the original news sender hurts in particular “moderate” voters. In equilibrium these voters know that a moderate interest group would inform them correctly but a radical interest group would always send them the same uninformative message. Thus, if moderate

¹¹One of the core findings in the empirical literature on the political economy of the media is that voters update their beliefs differently for different sources if they know about the political position of the information sender (Prat and Strömberg, 2013). For instance, Chiang and Knight (2011) find that newspapers’ endorsements of presidential candidates have more influence on voting intentions if they are ideologically surprising (e.g., endorsements of Republican candidates are more influential if they come from left-wing newspapers than if they come from right-wing newspapers).

voters are aware of the interest group’s position, they can either completely rely on the message received or completely discard it. Without awareness, moderate voters have to guess, which means that they will sometimes discard a truthful message from a moderate interest group and sometimes believe an uninformative message sent by a radical interest group. Both changes hurt the payoffs of moderate voters.

An additional feature of the model is that, while we only assume a binary message space (either a left-wing or a right-wing policy is objectively best), in equilibrium interest groups use it for two different purposes: to *persuade* moderate voters to vote in favor of the interest group’s preferred party, and simultaneously to *mobilize* (*demobilize*) radical voters who are in favor of (against) the group’s favorite party. Moreover, we show that, next to (stable) radical and moderate voters, a third category of voters exists, which we coin *unstable moderate voters*: they behave like radicals in games with unawareness but like moderate voters in games with awareness of the news sender’s position.¹²

An important finding with policy implications is the voter-welfare ranking among our games: the *public game with voter awareness* is ranked highest, whereas the *microtargeting game with voter unawareness* is ranked lowest. The other two games occupy intermediate ranks, depending on parameter values. Additionally, we show that voter unawareness is a necessary condition for *election flipping* (to change the election winner). Microtargeting alone (without also assuming voter unawareness) cannot distort election outcomes qualitatively.

These results allow the theory-based discussion of policy proposals.¹³ One proposal is that news platforms could be compelled to *implement technologies by which users can identify a message’s original sender*, which should help users to also infer the political position of the sender of the message. In our model’s language, this provision would help to establish *awareness* among voters and thereby decrease the risk of flipping election outcomes even in the presence of *microtargeting*.¹⁴ Other policy proposals we discuss are to ban microtargeting or to require a minimum numbers of receivers getting the same message.

The paper proceeds as follows. In the next section, we review the related literature. We describe the formal model and offer a discussion of important assumptions in Section

¹²Given that news platforms create more unawareness, this finding suggests that *c.p.* today more people behave like radical voters, *i.e.*, they do not update beliefs after receiving news, than 20 years ago.

¹³The question *whether* social media should be regulated is not top of the list, any longer. Instead, insights into *how* and *why* to regulate are needed. In February 2020, Facebook’s Mark Zuckerberg was reported to say that regulatory boundaries would give citizens “confidence” that tech giants were following a set of rules agreed by everyone, and that users “don’t want private companies taking decisions on how to balance social equities without a democratic process” (<https://www.euronews.com/2020/02/15/zuckerberg-tells-europe-regulate-soon-or-authoritarian-china-will-set-the-rules-on-social>).

¹⁴Note that Facebook recently implemented the following requirement in its Custom Audience service: “In the drop-down menu of each ad, the “Why am I seeing this?” section will show people the *source of the information* (advertiser or partner) [...]”, our emphasize. For details, see <https://www.facebook.com/business/news/introducing-new-requirements-for-custom-audience-targeting>. However, it remains unclear how much this feature is used and to what extent it diminishes users’ unawareness.

3. The model is analyzed in Section 4, where we provide a characterization of the voter-welfare maximizing equilibria in each of the four games mentioned above and compare the outcomes of the games. In Section 5, we study voter welfare, discuss conditions under which an election can be flipped, and analyze competition among interest groups. In Section 6 we interpret some stylized facts about the development of news dissemination technologies since the 1990s through the lens of our model and bring it together with evidence about trust in political institutions in the U.S. We then discuss various policy proposals before we conclude in Section 7. All proofs of formal results are deferred to the Appendix.

2 Literature Review

To our knowledge, we are the first to analyze the effects on voting behavior of interest groups' information provision on news platforms. In this way, our paper contributes to the literature on interest groups' influence on policy outcomes through information transmission to voters.¹⁵ Like us, [Shapiro \(2016\)](#) studies the effects of false claims made by interest groups on voting behavior. Whereas we study direct communication from an interest group to voters, [Shapiro \(2016\)](#) develops a theoretical model in which an interest group can only reach voters through a journalist's news coverage.¹⁶ In the model, two interest groups compete to influence profit-maximizing journalist, who in turn provides information to a voter on an unknown, binary, policy-relevant state. Each interest group represents one state and can produce a claim that contradicts the truth. Both the interest groups and the journalist are informed about the true state. Nevertheless, to avoid appearing captured by one of the interest groups, the journalist has a reputational incentive for balanced reporting, even when all available facts unambiguously point at the true state. Both [Shapiro \(2016\)](#) and our paper find that disclosure of the information sender's political position helps voters but the reasoning behind our findings is different. In the framework of [Shapiro \(2016\)](#), disclosure takes away the journalist's reputational incentive to report an ambiguous news item when facts are not in line with his predisposition. In our framework, voters benefit from disclosure even though reputation plays no role.

Our paper also adds to theoretical research on supply-driven media bias and political outcomes, in which media organizations may manipulate news content to advance the ideological agenda of journalists ([Baron, 2006](#)), editors ([Sobbrio, 2014](#)), and media owners

¹⁵Most of the literature on interest group's influence on policy outcomes studies direct lobbying of politicians by interest groups. See [Grossman and Helpman \(2001\)](#) and [Van Winden \(2004\)](#) for a broad discussion on the role of interest groups in the policy making process.

¹⁶Papers by [Sobbrio \(2011\)](#) and [Petrova \(2012\)](#) are other examples of theoretical studies on the influence of interest groups on policy outcomes through their effect on media reporting by journalists. [Sobbrio \(2011\)](#) considers policy-motivated media outlets, [Petrova \(2012\)](#) analyzes the link between advertising profitability and media bias.

(Anderson and McLaren, 2012), or yield to pressure from governments (Besley and Prat, 2006) and advertisers (Ellman and Germano, 2009). A typical supply-driven media bias model contains a media outlet that commits to a (potentially biased) reporting strategy to maximize a payoff function that captures both a profit motive and a political or commercial motive.¹⁷ Our model differs from this framework in that we abstract from any potential profit motive that an interest group might have and that the reporting strategy is unobservable to voters.

Our paper adds to an emerging, and mostly empirical, literature on the political effects of social media, reviewed by Zhuravskaya, Petrova, and Enikolopov (2020), Tucker et al. (2018) and Martens et al. (2018). With our attention to microtargeted news dissemination, we relate to Liberini et al. (2018), who study Facebook advertisement price variation for different audiences and ask to what extent political campaigns during 2016 U.S. Presidential elections used social media to microtarget voters.¹⁸ They find that the Republican campaign used extensive Facebook ads and microtargeting. They also attempt to measure the effect size, if any, on voters' election behavior if they were heavily exposed to campaigning on social media. Here they conclude that microtargeted ad campaigns had significant effect on voting behavior. To the best of our knowledge, this is the first and only study of its kind, which documents the role of social media for election results (both on inputs and on outputs of manipulation attempts). Theoretical work on microtargeted advertising in political campaigns includes Hoffmann, Inderst, and Ottaviani (2019), Boyer, Konrad, and Roberson (2017), Schipper and Woo (2019), and Sharma and Wagman (2019). Whereas these papers study targeted communication from *political parties*, we analyze reporting from *political interest groups* with targeting capability. In our framework, voters cannot share the news items they receive with other voters. Pogorelskiy and Shum (2019) develop and experimentally test a theoretical model on news sharing in a network, media bias, and voting behavior. In their model, voters with a partisan bias receive a (biased) signal about a policy-relevant state, which they decide to share or not to share with other voters in their polarized (consisting of like-minded voters) or complete (consisting of all voters) networks, after which they make a voting decision. They find that media bias has a stronger effect on voting behavior than clustering of voters by partisan biases. Relatedly, there also exists an economic literature on (online) echo chambers (Levy and Razin, 2019), which result from the choice of news consumers to cluster with like-minded others in combination with a number of behavioral biases. In our model, voters do not choose their news source (the interest group). Instead, we assume that voters are randomly matched to an interest group to capture the gatekeeper role of the platform's algorithm.¹⁹

¹⁷See Gentzkow, Shapiro, and Stone (2015) for a thorough survey on the theoretical media bias literature.

¹⁸Nickerson and Rogers (2014) review economic literature on targeted political advertising.

¹⁹Of course, news consumers ultimately decide what news they consume on a platform. However, the

Lastly, our model builds on cheap talk models, in which a sender observes a payoff-relevant state and sends a costless and non-verifiable message to an uninformed receiver, who then chooses an action that determines the payoffs of both sender and receiver together with the players' respective types. [Li and Madarász \(2008\)](#) extend the canonical cheap talk model by making the type of the sender (her bias relative to the receiver) her private information, which relates to our model with voter unawareness about interest groups' ideologies. The authors show that disclosure of the sender's type always hurts communication when the direction of the sender's bias is uncertain. Without disclosure, the receiver will stay closer to the recommendation of the sender because he does not know whether the message is an understatement or exaggeration, which provides the sender an incentive to be more precise in the recommendation than in case of disclosure. This mechanism does not apply in our framework. Whereas [Li and Madarász \(2008\)](#) consider two sender types with state-dependent preferences, we consider sender types with state-dependent preferences (moderate interest groups) and state-independent preferences (radical interest groups) over voters' actions. A sender with state-independent preferences never has an incentive for communication. Hence, introducing uncertainty about the type of sender (as we do in our model with voter unawareness) makes communication *less* instead of more informative in expectation. [Farrell and Gibbons \(1989\)](#) and [Goltsman and Pavlov \(2011\)](#) study cheap talk communication with multiple audiences, which resembles news reporting in our microtargeting game.²⁰ Like them, we find that a restriction to send the same message to multiple audiences can discipline the sender to transmit information to audiences that otherwise would receive uninformative communication.

3 The Political News Game

We first describe the model setup before we discuss its key assumptions in subsection [3.2](#).

3.1 Model

The game features two kinds of players, an interest group and voters, who act in a world in which a news platform disseminates political news from interest groups to the voters and voters can elect political parties. There are two political parties, indexed by $j \in \{L, R\}$.

platform's algorithm plays a major role in this decision. For instance, users of a search ranking are more likely to select higher-ranked results than lower-ranked results ([Epstein and Robertson, 2015](#)).

²⁰[Battaglini and Makarov \(2014\)](#) and [Drugov et al. \(2017\)](#) study cheap talk games with multiple audiences in a laboratory experiment.

Voters' preferences and actions: It is common knowledge that party L and party R are committed to implement policies x_L and x_R , respectively, if elected. These policies are elements of a left-right political spectrum (more on this below) and are exogenously given. Voters have preferences over policies and receive expressive utility from voting. Voters are characterized by their position y on the left-right spectrum $[-b, b]$, meaning that voter $-b$ has the most left-wing ideological position and voter b has the most right-wing ideological position. Voter ideologies are uniformly distributed on $[-b, b]$. A voter's ideal policy x_v depends on her ideological position y and the state of the world $\theta \in \{-1, 1\}$, which, however, voters cannot observe:

$$x_v(y, \theta) = y + \theta. \quad (1)$$

Hence, all voters prefer a relatively more left-wing policy if $\theta = -1$ and a more right-wing policy if $\theta = 1$. Each voter chooses a voting action $a \in \{L, R, 0\}$, where $a = L$ if she votes for party L, $a = R$ if she votes for party R, and $a = 0$ if she abstains from voting. A voter's utility from voting in the absence of voting costs is specified as follows:

$$U(a, y, \theta) = \begin{cases} g - t(x_a - x_v(y, \theta))^2 & \text{if } a \in \{L, R\} \\ 0 & \text{if } a = 0. \end{cases} \quad (2)$$

The parameter g represents the direct psychological gain that a voter derives from voting. The utility received from voting for party j is decreasing in the mismatch cost $t(x_j - x_v)^2$ that the voter incurs if her ideal policy differs from party j 's policy position. Utility from abstaining is equal to 0. Each voter y incurs a cost of voting, $c_y \in [0, \bar{c}]$, which is independent of y and θ and is an *i.i.d.* draw from a uniform distribution with support on $[0, \bar{c}]$. Net voter utility is equal to $U(a, y, \theta) - c_y$ if $a \in \{L, R\}$ and 0 otherwise. Voter welfare, which will be analyzed in Section 5.1, is defined as:

$$W(a, c, \theta) = \int_{-b}^b U(a, y, \theta) dy - \int_{-b}^b \mathbb{1}_{\{a_y \in \{L, R\}\}} c_y dy. \quad (3)$$

Voters' beliefs: Voters have common prior beliefs about the state of the world. We define voters' *prior belief* $p = \Pr(\theta = -1)$, where $0 < p < 1$. Before voting, voters receive via a news platform a single cheap talk news item $m \in \{-1, 1\}$ concerning the state of the world. Denote by $\mu(m) = \mu(\theta = -1|m)$ the probability (*posterior belief*) that a voter assigns to the event $\theta = -1$ after observing news item m . Denote by $\mathbb{E}[U(a, y, \theta) | \mu(m)]$ a voter's expected utility from voting if she has ideological position y and posterior belief $\mu(m)$.

Interest Group: There is a single ideologically motivated interest group that accurately observes the state of the world and sends a news item about the state of the world θ . The

interest group has ideological position z , which is drawn from a uniform distribution with support on $[-h, h]$ and is unobserved by voters. Similar to voters' preferences, the ideal policy position of the interest group, x_n , is determined by its ideological position z and the state of the world θ :

$$x_n(z, \theta) = z + \theta. \quad (4)$$

The interest group reports cheap talk news item $m \in \{-1, 1\}$ and earns the payoff

$$\Pi(a, z, \theta) = -\nu_L(a)(x_L - x_n(z, \theta))^2 - (1 - \nu_L(a))(x_R - x_n(z, \theta))^2, \quad (5)$$

where

$$\nu_L(a) = \frac{\int_{-b}^b \mathbb{1}_{\{a_y=L\}} dy}{\int_{-b}^b \mathbb{1}_{\{a_y=L\}} dy + \int_{-b}^b \mathbb{1}_{\{a_y=R\}} dy} \quad (6)$$

denotes party L 's vote share, and $(x_L - x_n(z, \theta))^2$ is the interest group's mismatch cost if $x_n \neq x_L$. Analogous for party R .

Four Games: We study the interaction of two news dissemination technologies and two awareness states of the voters about the ideological position of the interest group z , resulting in four different games. We will first focus on the two games in which voters are aware and then on the two games in which voters are unaware of z . In the *public games*, the interest group is restricted to producing a single news item $m \in \{-1, 1\}$ for the entire electorate. In the *microtargeting games*, the interest group reports a news item $m_y \in \{-1, 1\}$ for each voter y . In all games, the interest group may misrepresent the true state of the world. Voters have no way to learn about θ apart from observing m .

All aspects of the game (but not the realizations of θ, z , and c_y) are common knowledge. In particular, voters know the distribution of interest group ideologies and the news dissemination technology that is in place.

Timing: The timing of a game is as follows:

- Stage 0 Nature determines θ according to p , draws $c_y \sim U[0, \bar{c}]$ for each voter y , and draws $z \sim U[-h, h]$ for the interest group. Each voter y privately learns c_y and the interest group learns z and observes θ .
- Stage 1 The **interest group** chooses $\mathbf{m} \in \{-1, 1\}$ in the **public game** and $\mathbf{m}_y \in \{-1, 1\}$ for each voter y in the **microtargeting game**.
- Stage 2 **Each voter y** observes news item m if a public news dissemination technology is in place and m_y if microtargeted news dissemination technology is available. Each

voter **updates belief** μ , and **chooses voting action** $\mathbf{a} \in \{\mathbf{L}, \mathbf{R}, \mathbf{0}\}$. All payoffs are realized.

Equilibrium Concept: Our solution concept is Perfect Bayesian Nash Equilibrium (PBE) (Fudenberg and Tirole, 1991).

Definition 1. A Perfect Bayesian Nash Equilibrium of the game is a reporting strategy m^* of an interest group, voting strategy a^* of a voter, and a belief μ^* that satisfy the following conditions:

(1) For all m , the voter chooses the best voting action a^* , which is defined as:

$$a^*(y, m, c_y) = \begin{cases} L & \text{if } \mathbb{E}[U(a = L, y, \theta) | \mu^*] > \max\{\mathbb{E}[U(a = R, y, \theta) | \mu^*], c_y\} \\ R & \text{if } \mathbb{E}[U(a = R, y, \theta) | \mu^*] > \max\{\mathbb{E}[U(a = L, y, \theta) | \mu^*], c_y\} \\ 0 & \text{otherwise.} \end{cases} \quad (7)$$

(2) Given (7), $m^*(z, \theta)$ is the news reporting strategy that maximizes the payoff of an interest group with ideology z .

(3) For all m , a voter updates her belief μ^* using Bayes' rule whenever possible.

The games we analyze have multiple PBEs. Therefore, we focus on the *Voter Welfare-Maximizing Perfect Bayesian Equilibrium (VWMPBE)* (i.e., the equilibrium with the highest voter welfare). As we will show for all games, this equilibrium coincides with the equilibrium in which most voters receive news that is informative to them.²¹ News reporting is *informative* to a voter if there is a news item m that is reported with positive probability on the equilibrium path such that $\mu(m) \neq p$, i.e. voters' beliefs about the state of the world are actually influenced by the message. Since we only allow for binary news reports, informativeness of news implies that $\mu(m = -1) \neq \mu(m = 1)$. For the sake of simplicity, we limit our attention to the VWMPBE in which $\mu^*(m = -1) \geq \mu^*(m = 1)$ for all voters and ignore essentially equivalent equilibria that are formed by permuting the messages $m = -1$ and $m = 1$. Hence, we focus on cases where receiving the message $m = -1$ makes more voters believe that the state of the world is actually $\theta = -1$ than if they receive the message $m = 1$ in equilibrium.

We make two assumptions regarding the equilibrium reporting strategy to eliminate multiple equilibria in which voting behavior is the same. First, if news are uninformative

²¹The Perfect Bayesian Equilibrium with the *lowest* voter welfare coincides with the *babbling* equilibrium, in which news is uninformative to each voter. As in all cheap talk games, all our four games have babbling equilibria. Voting actions and voter welfare are identical in the babbling equilibria of the four games.

to a voter in equilibrium (*i.e.*, if $\mu^*(m = -1) = \mu^*(m = 1) = p$) for *any* interest group ideology z , we assume that the interest group randomizes between $m = -1$ and $m = 1$ with probability p . Second, if news are uninformative to a voter in equilibrium for ideology z' but not for *all* $z \in [-h, h]$, we assume that the interest group with ideology z' mimics the equilibrium reporting behavior of the ideologically closest interest group for which news reporting is informative.

Technical Assumptions: Finally, we make assumptions on parameter values and introduce notation that will facilitate the equilibrium analysis.

According to (7), a voter chooses to vote for party j in equilibrium if both her incentive compatibility constraint and her participation constraint are satisfied, *i.e.* if the voter prefers voting for party j both over the other party and over abstaining. A voter with belief μ' is *indifferent* between voting for parties L and R if she has ideological position

$$\hat{y}_{\{\mu'\}} = \frac{x_L + x_R}{2} + 2\mu' - 1, \quad (8)$$

which solves the equality $\mathbb{E}[U(a = L, y, \theta) | \mu'] = \mathbb{E}[U(a = R, y, \theta) | \mu']$.²² It is *incentive compatible* for a voter y with belief μ' to vote for party L (party R) if she has a more left-wing (right-wing) ideology than the *indifferent voter*:

$$y < \hat{y}_{\{\mu'\}} (\mathbf{IC}_L), \quad (9)$$

and

$$y > \hat{y}_{\{\mu'\}} (\mathbf{IC}_R). \quad (10)$$

The ideological position of the indifferent voter with belief $\mu' \in [0, 1]$, denoted by $\hat{y}_{\{\mu'\}}$, is only well-defined if $-b < \hat{y}_{\{\mu'\}} < b$. To ensure this, we make:

Assumption 1: $-b + 1 < x_L < x_R < b - 1$.

This implies that each party is preferred by at least some voters, regardless of the state of the world.

A voter y with belief μ' prefers voting for party j over abstaining if her *participation constraint* is satisfied: That is, if

$$c_y < \mathbb{E}[U(a = j, y, \theta) | \mu'] (\mathbf{PC}_j). \quad (11)$$

We assume that the direct psychological gain from voting for a party with the voter's

²²Note that there can be multiple indifferent voters, as posterior beliefs might differ across voters.

ideal policy position outweighs the mismatch cost, for all y , but is lower than the maximal voting cost, regardless of the voter's belief and the locations of party platforms:

Assumption 2: $4tb^2 < g < \bar{c}$.

Hence, ex ante each voter y with belief $\mu \in [0, 1]$ votes and abstains with positive probability, which makes sure our model is interesting. Since the voters' costs of voting are independently drawn from a uniform distribution, this assumption allows us to write the probability that a voter $y \in [-b, \hat{y}_{\{\mu'\}})$ with belief μ' votes for party L as $\mathbb{E}[U(a = L, y, \theta) | \mu'] / \bar{c}$.²³ Similarly, the probability that a voter $y \in (\hat{y}_{\{\mu'\}}, b]$ with belief μ' votes for party R is given by $\mathbb{E}[U(a = R, y, \theta) | \mu'] / \bar{c}$. We use these expressions of the voting probabilities of individual voters to state aggregate voting behavior in a concise manner. We denote the *turnout* for party j by τ_j and define it as the expected share of all voters who vote for party j . Formally,

$$\tau_L = \int_0^1 \int_{-b}^{\hat{y}_{\{\mu'\}}} \mathbb{1}_{\{\mu_y = \mu'\}} \frac{\mathbb{E}[U(a = L, y, \theta) | \mu']}{2b\bar{c}} dy d\mu' \quad (12)$$

and

$$\tau_R = \int_0^1 \int_{\hat{y}_{\{\mu'\}}}^b \mathbb{1}_{\{\mu_y = \mu'\}} \frac{\mathbb{E}[U(a = R, y, \theta) | \mu']}{2b\bar{c}} dy d\mu', \quad (13)$$

where μ_y indicates the belief of voter y .²⁴ The probability that a voter y turns out to vote for party j is calculated for all possible voter beliefs, contributing only to total party turnout if the considered belief equals the voter's actual belief (*i.e.*, if $\mu_y = \mu'$). We can calculate party L 's *vote share* from the turnout for party L and party R as:

$$\nu_L = \frac{\tau_L}{\tau_L + \tau_R}. \quad (14)$$

It follows from (5) that the interest group is *indifferent* between a vote cast for party L and a vote cast for party R if it has ideological position

$$\hat{z}(\theta) = \frac{x_L + x_R}{2} - \theta, \quad (15)$$

which solves the equality $(x_L - x_n)^2 = (x_R - x_n)^2$. An interest group with ideological position z favors party L if $z \leq \hat{z}(\theta)$ and party R if $z > \hat{z}(\theta)$.²⁵

²³Note that $\mathbb{E}[U(a = L, y, \theta) | \mu']$ has the minimum $g - 4b^2 > 0$ (see (2) and Assumption 1) and the maximum g ; see equ. (2). Hence, $0 < \mathbb{E}[U(a = L, y, \theta) | \mu'] / \bar{c} < 1$ because of Assumption 2.

²⁴Janssen and Teteryatnikova (2016, 2017) use a similar formulation but only allow for identical beliefs of voters.

²⁵As a tie-breaker, we assume that the *indifferent interest group* acts as if it favors party L .

Lastly, we restrict the parameter h such that there is an, ex ante, positive probability that the interest group favors each party L and R in both states of the world:

Assumption 3: $-h + 1 < x_L < x_R < h - 1$.

3.2 Model Discussion

Voters' utility: The probability that a single vote is decisive is low in large elections. Hence, it is unlikely that rational voters will turn out to vote if they are solely interested in the election outcome (Downs, 1957). Turning out to vote is not paradoxical if voters derive direct *expressive utility from voting*.²⁶

Interest group's payoffs and information: As we assume the same structure of the ideal policy position of voters (1) and interest groups (4), the latter can be thought of as being managed by members of the electorate, thereby reflecting democracy. The weighted mismatch cost of interest groups (5) captures that parties' political influence is likely to depend on their vote shares. For example, the number of seats held in parliament or the amount of campaign contributions received might be proportional to a party's vote share. We assume that the interest group, having access to expert knowledge and resources, is perfectly informed about the true state of the world.²⁷

A single interest group: This assumption is a shortcut for assuming that there are multiple interest groups each sending one piece of news but that the news platform only forwards one randomly selected group's message to all voters. We study the case of competing messages received by a voter in Section 5.3.

Perfect rationality: We model perfectly rational voters, who understand the incentives of interest groups to misreport news. This is a strong assumption as many human beings, and hence voters, have cognitive limitations and imperfect foresight. However, the significance of our results is strengthened if we can show that and how even rational voters can be manipulated in equilibrium and make voting decisions that are against their own interests. Then, voters with naive beliefs about political messages could be manipulated even easier by demagogues. Alternatively, assume that only a share $\alpha \in (0, 1)$ of voters are rational (Bayesian updaters) and that $1 - \alpha$ voters do not update their beliefs. Then, if α is not

²⁶Expressive voters are frequently modeled in political economics (e.g., Schuessler (2000) and Glaeser, Ponzetto, and Shapiro (2005)). There is ample empirical support for the expressive voting theory (e.g., Pons and Tricaud (2018)).

²⁷We refer to Shapiro (2016) and Kartal and Tremewan (2018) for a more extensive discussion on the justification for maintaining this assumption.

correlated with y , our results hold for the rational voters and, hence, qualitatively for the entire electorate. By contrast, if α and y were correlated, it would affect our results also qualitatively. However, we are not aware of conclusive evidence that left voters are significantly more Bayesian than right voters, or vice versa.

Prior beliefs: We assume common prior beliefs for tractability. Alternatively, we could replace the common prior belief p by an individual belief p_y for each voter y . Qualitatively, our results would stay the same. Posterior beliefs $\mu(m)$ can differ across voters, which is a crucial feature in our microtargeting games.

Compulsory voting: If voting were compulsory (*i.e.*, if voters could not abstain), the participation constraint (PC_j) would not apply. However, endogenizing participation in elections provides us with results and intuition about different reporting strategies of interest groups when they maximize their preferred party’s vote share, for which either the participation constraint or the incentive compatibility constraint of certain voter groups can be targeted (see next section). Empirically, voting is only compulsory in 13% of all countries, whereas it is not compulsory in 85% (in 2% there are no elections).²⁸

Disinformation vs. fake news: We assume that all interest groups are only motivated by political interests and not, for instance, by a preference for truth telling. In reality, some interest groups may want to develop a reputation for truth telling but this is immaterial in our non-repeated adverse selection model. Nevertheless, we will show that, depending on the game we are analyzing, moderate interest groups still report truthfully in specific, clearly delineated cases (but not for reputational reasons). By contrast, note that *disinformation* is not the same as lying or spreading of “fake news.” For instance, an interest group may convey an entirely different message by strategically choosing which events (that actually occurred) it includes or excludes from its news reporting.

4 Equilibrium Analysis

We will now analyze the four games described in the previous Section varying the communication technology the interest group has access to (public vs. microtargeting) and voters knowledge about the political orientation of the interest group (awareness vs. unawareness).

In all four games, each voter y wants to vote for the party that is closest to her ideal policy $x_v(y, \theta)$, which depends on the state of the world θ . The difficulty of a voter’s decision, which party to vote for (if voting is preferred over abstaining), arises because a voter does

²⁸<https://www.idea.int/data-tools/data/voter-turnout/compulsory-voting>.

not know the state of the world θ . In forming a belief about θ , she has two inputs: the prior belief p about the state of the world being $\theta = -1$ (in which case a left-wing policy is better and voting for party L is potentially preferred) and the message from the interest group, m . On the one hand, the news item is potentially valuable to the voter because the voter knows that the interest group has perfect knowledge about θ , and so the news item received might contain information about θ . On the other hand, the voter also knows that the interest group's payoff increases if it can make the voter vote for the party that is closest to the interest group's ideological position. Therefore, our model captures a situation where voters should be "suspicious" about the message sent by an interest group, which is due to the information asymmetry between the group and voters about the state of the world (in all games) and about the interest group's ideological position (in the games with unawareness).

4.1 Public Game with Voter Awareness

In our first game, the voter knows the political position z of the interest group, which prevents information asymmetry about the interest group's objectives. However, the voter does not know θ . The interest group, in turn, knows all aspects of the game apart from the realization of an individual voter's voting cost c_y . This ignorance does not affect its decision, though. Recall Definition 1 and the notation we introduced in (8) and (15). We show in the Appendix that the following proposition holds.

Proposition 1. *The following strategy profiles and beliefs constitute the voter welfare-maximizing Perfect Bayesian Equilibrium of the public game with voter awareness:*

$$a^*(y, c_y, m, z) = \begin{cases} L & \text{if } y < \hat{y}_{\{\mu^*(m, z)\}} \text{ and } c_y < \mathbb{E}[U(a = L, y, \theta) | \mu^*(m, z)] \\ R & \text{if } y > \hat{y}_{\{\mu^*(m, z)\}} \text{ and } c_y < \mathbb{E}[U(a = R, y, \theta) | \mu^*(m, z)] \\ 0 & \text{otherwise,} \end{cases} \quad (16)$$

$$m^*(z, \theta) = \begin{cases} -1 & \text{if } z \leq \hat{z}(\theta) \\ 1 & \text{if } z > \hat{z}(\theta), \end{cases} \quad (17)$$

$$\mu^*(m = -1, z) = \begin{cases} p & \text{if } z \leq \hat{z}(\theta = 1) \text{ or } z > \hat{z}(\theta = -1) \\ 1 & \text{if } \hat{z}(\theta = 1) < z \leq \hat{z}(\theta = -1), \end{cases}$$

$$\mu^*(m = 1, z) = \begin{cases} p & \text{if } z \leq \hat{z}(\theta = 1) \text{ or } z > \hat{z}(\theta = -1) \\ 0 & \text{if } \hat{z}(\theta = 1) < z \leq \hat{z}(\theta = -1). \end{cases} \quad (18)$$

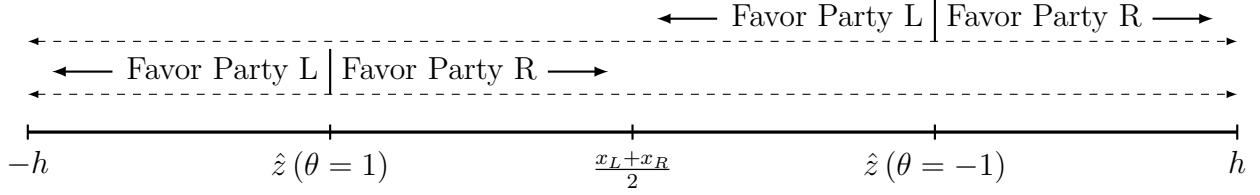


Figure 1: Location of the indifferent interest group conditional on the state of the world.

Intuitively, the decision rule (16) shows that a voter only votes for her preferred party if the expected utility from voting exceeds her voting cost. An interest group with rather left-wing (right-wing) ideology prefers voters to cast their vote for the left (right) party. However, equation (15) establishes that “rather left-wing” depends on the state of the world. This equation cuts the space of interest group ideologies (ranging from $-h$ to h) into three subspaces, as depicted in Figure 1. If interest group ideology z is “moderate,” *i.e.* if $\hat{z}(\theta = 1) < z \leq \hat{z}(\theta = -1)$, then it depends on the state of the world which party the interest group favors. However, if interest group ideology is “radical,” *i.e.* if $z \leq \hat{z}(\theta = 1)$ or $z > \hat{z}(\theta = -1)$, then the interest group’s favorite party is state-independent.

As a next step, equation (17) shows that the interest group has no incentive to report a message that would favor its non-preferred party. Therefore, it reports $m = -1$ if it favors party L and $m = 1$ if it favors party R . This shows that (endogenously emerging) moderate interest groups use their information about the state of the world when communicating to voters, whereas radical interest groups do not but always report $m = -1$ (left-wing radical) or $m = 1$ (right-wing radical), whether it is truthful, or not.

The rational voters in our game understand the interest group’s strategy. Therefore, if the interest group’s ideology is moderate, voters assign a higher probability to $\theta = -1$ if they receive the message $m = -1$ rather than $m = 1$. Therefore, the indifferent voter is located further to the right of the political spectrum for $m = -1$ than for $m = 1$. This is captured analytically by (8) and visualized in Figure 2. This Figure also shows that, just as interest groups, voters endogenously come in two variants in our model: “moderate” voters with state-dependent party preferences (with $\hat{y}_{\{\mu^*(m=1)\}} < y < \hat{y}_{\{\mu^*(m=-1)\}}$) and “radical” voters (with y outside of these bounds) whose party preferences do not depend on their beliefs about θ .

As voters can observe z perfectly in this game, they can update their belief about the state of the world conditional on z . Equation (18) shows that voters trust the messages of moderate interest groups fully, whereas they refrain from updating their prior beliefs after receiving news from a radical interest group.

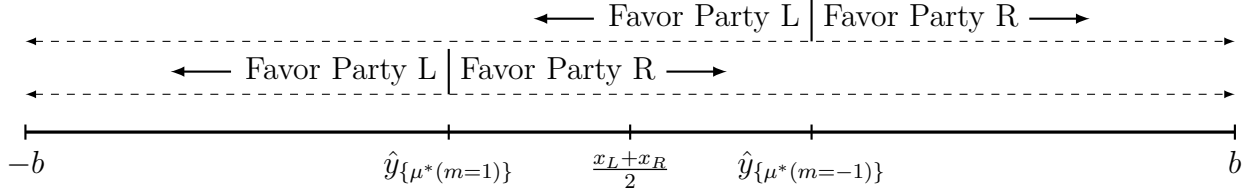


Figure 2: Location of the indifferent voter conditional on the public news item received.

4.2 Public Game with Voter Unawareness

In this game the interest group is still restricted to sending one uniform and public message about the state of the world to all voters (*e.g.* because it does not have sufficient information about the political position of individual voters) but where voters are unaware of the political position of the sender of a message (*e.g.* because they have no information about the owner/sponsor of a certain news agency or the author of a social media account).

Proposition 2. *The following strategy profiles and beliefs constitute the voter welfare-maximizing Perfect Bayesian Equilibrium of the public game with voter unawareness:*

$$a^*(y, c_y, m) = \begin{cases} L & \text{if } y < \hat{y}_{\{\mu^*(m)\}} \text{ and } c_y < \mathbb{E}[U(a = L, y, \theta) | \mu^*(m)] \\ R & \text{if } y > \hat{y}_{\{\mu^*(m)\}} \text{ and } c_y < \mathbb{E}[U(a = R, y, \theta) | \mu^*(m)] \\ 0 & \text{otherwise,} \end{cases} \quad (19)$$

$$m^*(z, \theta) = \begin{cases} -1 & \text{if } z \leq \hat{z}(\theta) \\ 1 & \text{if } z > \hat{z}(\theta), \end{cases} \quad (20)$$

$$\mu^*(m = -1) = \frac{p(2(h+1) + x_L + x_R)}{2(h+2p-1) + x_L + x_R},$$

$$\mu^*(m = 1) = \frac{p(2(h-1) - x_L - x_R)}{2(h-2p+1) - x_L - x_R}. \quad (21)$$

Proposition 2 shows that the incentives of interest groups are similar to the public game with voter awareness (20): moderate interest groups report truthfully, whereas radical groups report their preferred message state independent. Voters' best response to this reporting strategy is therefore also unchanged (19). See Figures 1 and 2.

What differs now is that voters do not know whether the sender of the message is a moderate or radical interest group. Therefore, voters have to form a belief, which depends

on the relative shares of left-wing radical, right-wing radical, and moderate interest groups (21). Consequently, they trust all news a bit—and hence news reporting is payoff-relevant for all voters. This implies that, as compared to the public game with awareness, in equilibrium some voters trust the disinformation of a radical interest group, whereas others will discount the truthful information from a moderate interest group. On the positive side, the discipline effect of the public news dissemination technology makes news from moderate interest groups informative even to radical voters, a feature that changes once microtargeting is possible.

4.3 Microtargeting with Voter Unawareness

Now we study the situation where the news platform collects and distributes news to voters who are unaware of an individual news source's political position. The platform has a lot of information about each voter and grants the possibility to interest groups to microtarget the message to every voter's individual characteristic (*i.e.*, to her political position).²⁹

Proposition 3. *The following strategy profiles and beliefs constitute the voter welfare-maximizing Perfect Bayesian Equilibrium of the microtargeting game with voter unawareness:*

$$a^*(y, c_y, m_y) = \begin{cases} L & \text{if } y < \hat{y}_{\{\mu^*(m_y)\}} \text{ and } c_y < \mathbb{E}[U(a = L, y, \theta) | \mu^*(m_y)] \\ R & \text{if } y > \hat{y}_{\{\mu^*(m_y)\}} \text{ and } c_y < \mathbb{E}[U(a = R, y, \theta) | \mu^*(m_y)] \\ 0 & \text{otherwise,} \end{cases} \quad (22)$$

$$m^*(z, \theta) =$$

$$\begin{cases} \begin{aligned} & m_y = -1 && \text{for } Y_1^U < y \leq Y_2^U \\ & m_y = -1 \text{ (or } 1) \text{ with prob. } p \text{ (or } 1-p) && \text{for } y \leq Y_1^U \text{ and } y \geq Y_2^U \end{aligned} & \text{if } z \leq \hat{z}(\theta) \\ \begin{aligned} & m_y = 1 && \text{for } Y_1^U < y \leq Y_2^U \\ & m_y = -1 \text{ (or } 1) \text{ with prob. } p \text{ (or } 1-p) && \text{for } y \leq Y_1^U \text{ and } y > Y_2^U \end{aligned} & \text{if } z > \hat{z}(\theta), \end{cases} \quad (23)$$

$$\text{where } Y_1^U = \min\{x_L, \hat{y}_{\{\mu_1\}}\} \text{ and } Y_2^U = \max\{x_R, \hat{y}_{\{\mu_2\}}\},$$

²⁹Whether the price for such targeting, *e.g.* for paid advertising, is > 0 or 0 , is immaterial for this paper.

$$\mu^*(m_y = -1) = \begin{cases} \mu_2 = \frac{p(2(h+1) + x_L + x_R)}{2(h+2p-1) + x_L + x_R} & \text{for } Y_1^U < y \leq Y_2^U \\ p & \text{for } y \leq Y_1^U \text{ and } y > Y_2^U, \end{cases}$$

$$\mu^*(m_y = 1) = \begin{cases} \mu_1 = \frac{p(2(h-1) - x_L - x_R)}{2(h-2p+1) - x_L - x_R} & \text{for } Y_1^U < y \leq Y_2^U \\ p & \text{for } y \leq Y_1^U \text{ and } y > Y_2^U. \end{cases} \quad (24)$$

Proposition 3 shows that voters' best voting action (22) has the same structure as in the public games (see (16) and (19)). However, the structure of the interest group's reporting strategy differs: while in the public games messages depend only on a group's own political position z (see (17) and (20)), now they also depend on voter characteristics y (23).

Nevertheless, due to Assumption 3, the interest group is still more likely to favor party L if $\theta = -1$ than if $\theta = 1$, as depicted in Figure 1. Therefore, moderate voters assign a higher probability to $\theta = -1$ if they receive the message $m_y = -1$ than if they receive $m_y = 1$ (24). Note that in this game, which voters are “moderate” or “radical” slightly differs from the public games. Figure 3.(a) captures the case where $x_L > \hat{y}_{\{\mu_1\}}$ and $x_R < \hat{y}_{\{\mu_2\}}$. Here, voters with positions $y \in [\hat{y}_{\{\mu_1\}}, \hat{y}_{\{\mu_2\}}]$ are moderate, *i.e.* they react to the message received by updating beliefs. By contrast, Figure 3.(b) captures the case where $x_L \leq \hat{y}_{\{\mu_1\}}$ and $x_R \geq \hat{y}_{\{\mu_2\}}$. Here, voters with positions $y \in [x_L, x_R]$ are “moderate.”

The news strategy (23) shows that moderate voters get truthful news from moderate interest groups. Their problem is that they cannot identify a news sender's type. Therefore, just as in the public game with unawareness, moderate voters react to news a bit (where the updating probability depends on the share of moderate vs. radical left and radical right interest groups; see μ_1 and μ_2 in (24)). However, “radical” voters realize that interest groups have an overwhelming incentive to disinform them in order to make them vote for the interest group's preferred party—and hence rationally ignore the content of all news.

Summarizing, we conclude that the disappearance of the disciplining effect of the public news dissemination technology by allowing microtargeting makes radical voters dismiss all incoming news. Moderate voters do take news into account when making voting decisions to some extent, which makes news payoff-relevant to them.

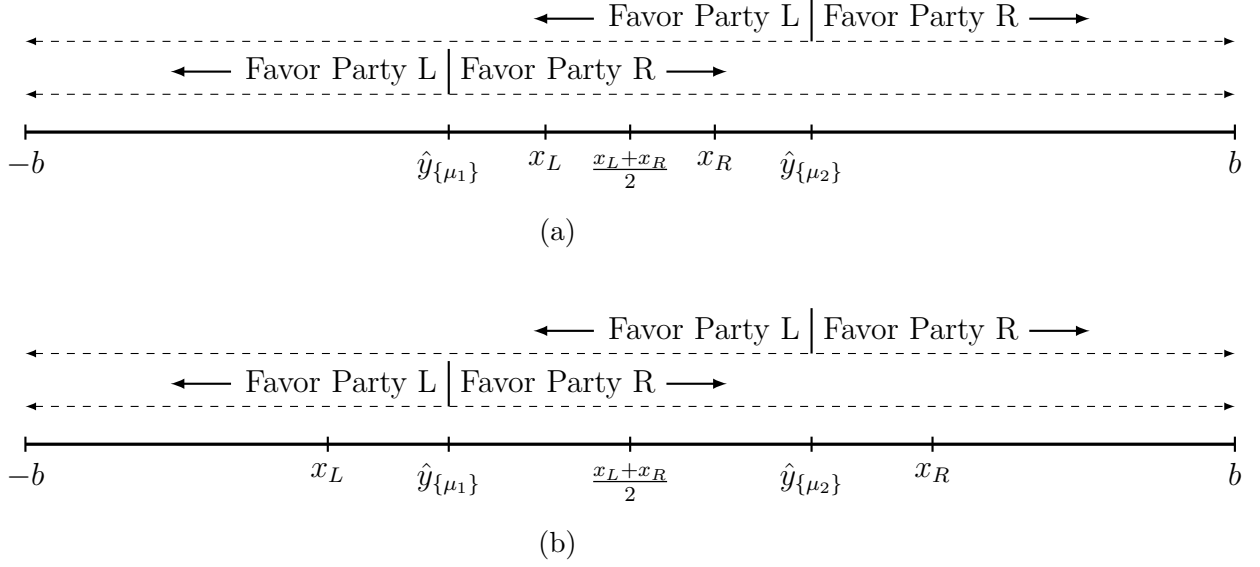


Figure 3: Location of the indifferent voter conditional on the microtargeted news item received. (a) $x_L > \hat{y}_{\{\mu_1\}}$ and $x_R < \hat{y}_{\{\mu_2\}}$. (b) $x_L \leq \hat{y}_{\{\mu_1\}}$ and $x_R \geq \hat{y}_{\{\mu_2\}}$.

4.4 Microtargeting with Voter Awareness

As a final game, we analyze the case where, due to the platform's knowledge about voters' preferences and characteristics, the interest group can microtarget voters—but where voters are aware of the political position z of the interest group.

Proposition 4. *The following strategy profiles and belief constitute the voter welfare-maximizing Perfect Bayesian Equilibrium of the microtargeting game with voter awareness:*

$$a^*(y, c_y, m_y, z) = \begin{cases} L & \text{if } y < \hat{y}_{\{\mu^*(m_y)\}} \text{ and } c_y < \mathbb{E}[U(a = L, y, \theta) | \mu^*(m_y)] \\ R & \text{if } y > \hat{y}_{\{\mu^*(m_y)\}} \text{ and } c_y < \mathbb{E}[U(a = R, y, \theta) | \mu^*(m_y)] \\ 0 & \text{otherwise,} \end{cases} \quad (25)$$

$$m^*(z, \theta) = \begin{cases} m_y = -1 & \text{for } Y_1^A < y \leq Y_2^A \\ m_y \in \{-1, 1\} \text{ (with prob. } p \text{ (or } 1-p)) & \text{for } y \leq Y_1^A \text{ and } y > Y_2^A \end{cases} \quad \text{if } z \leq \hat{z}(\theta)$$

$$\begin{cases} m_y = 1 & \text{for } Y_1^A < y \leq Y_2^A \\ m_y \in \{-1, 1\} \text{ (with prob. } p \text{ (or } 1-p)) & \text{for } y \leq Y_1^A \text{ and } y > Y_2^A \end{cases} \quad \text{if } z > \hat{z}(\theta), \quad (26)$$

where $Y_1^A = \min\{x_L, \hat{y}_{\{\mu=0\}}\}$ and $Y_2^A = \max\{x_R, \hat{y}_{\{\mu=1\}}\}$,

$$\mu^*(m_y = -1, z) = \begin{cases} 1 & \text{if } \hat{z}(\theta = 1) < z \leq \hat{z}(\theta = -1) \text{ and } Y_1^A < y \leq Y_2^A \\ p & \text{otherwise,} \end{cases}$$

$$\mu^*(m_y = 1, z) = \begin{cases} 0 & \text{if } \hat{z}(\theta = 1) < z \leq \hat{z}(\theta = -1) \text{ and } Y_1^A < y \leq Y_2^A \\ p & \text{otherwise.} \end{cases} \quad (27)$$

Proposition 4 shows that the structure of the interest group's reporting is similar to Proposition 3; see equ. (26): a moderate interest group's message to moderate voters contains correct information but all messages to radical voters are not informative. What is different in this game is that voters know who is sending the news they receive. Therefore, just as in the public game with awareness (Proposition 1), voters rationally ignore messages by radical groups and stick to their prior belief p ; see equ. (27). By contrast, moderate voters know that moderate interest groups tell the truth. Hence, they fully trust those messages.

4.5 The Persuasion, (De-)Mobilization, and Disciplining Effects

Based on Propositions 1 to 4, we identify several interesting mechanisms.

In the games with voters' unawareness about z , all interest groups can influence voters. Our analysis suggests two influence channels: one tries to affect the *incentive-compatibility constraint* of voters, *i.e.*, to persuade them to vote for the interest group's preferred party instead of the opponent. The other channel affects the *participation constraint* of voters, *i.e.*, to mobilize radicals that favor the interest group's preferred party to participate in the election or to demobilize radicals that favor the opponent by convincing them to abstain from voting. Therefore, in both games with unawareness the interest group can have a *persuasion effect* on moderate voters or a *(de)mobilization effect* on radical voters.³⁰

The two effects are illustrated in Figure 4 for an interest group that favors party L in a game in which $\hat{y}_{\{\mu_1\}} < x_L < x_R < \hat{y}_{\{\mu_2\}}$. In Figure 4, a “+” indicates a wanted effect for the interest group, whereas a “−” indicates an unwanted side-effect of sending $m = -1$. The interest group has the ability to persuade moderate voters ($\hat{y}_{\{\mu_1\}} < y < \hat{y}_{\{\mu_2\}}$) to favor party L over party R in both the public game (panel 4a) and the microtargeting game (panel 4b). However, in the public game sending $m = -1$ has an unwanted side-effect on radical voters.³¹ With microtargeting, this unwanted side-effect disappears because messages can

³⁰Empirically, Liberini et al. (2018) show that the advertisement strategies employed in the 2016 U.S. Presidential elections to (a) persuade swing voters to vote for candidate Trump and (b) to make Republican voters vote, differed substantially. In our theory, these two different effects arise endogenously despite the simple uni-dimensional message space, $\{-1, 1\}$.

³¹Specifically, sending $m = -1$ will demobilize radical left voters, who think that party L is not left enough, and mobilize radical right voters for party R , who would otherwise abstain but, after receiving

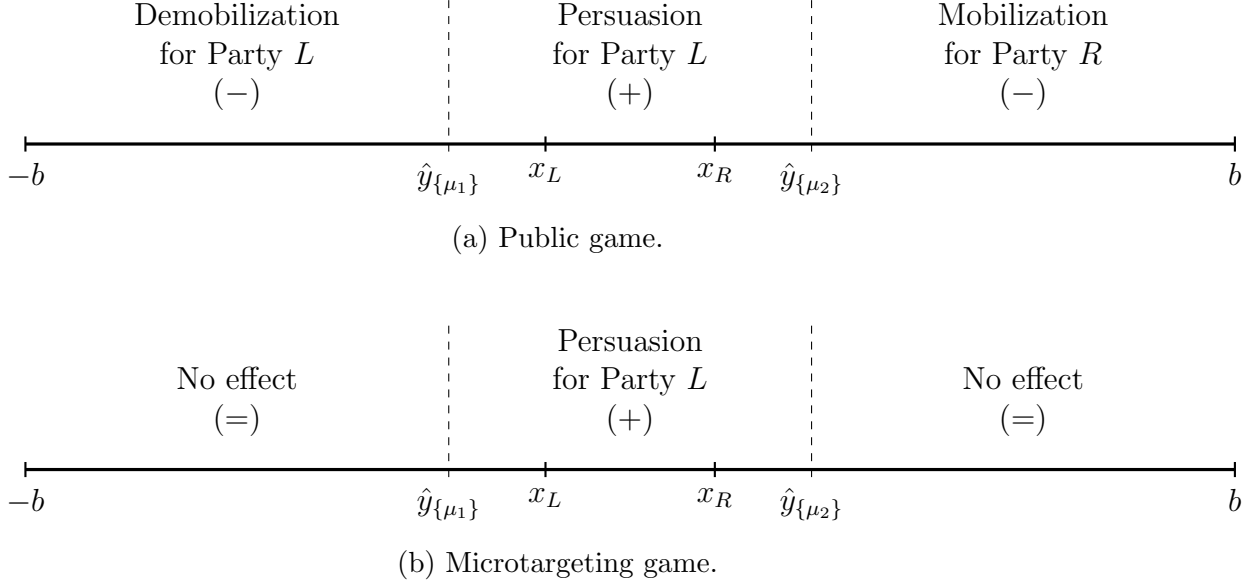


Figure 4: Influence on voting behavior by an interest group that favors party L .

be personalized to voter types.³²

Moreover, Propositions 1 to 4 show that a moderate interest group has an incentive to communicate truthfully to moderate voters because their voting preferences are aligned. This is different w.r.t. radical voters. However, if the interest group can only send one uniform message to all voters, there is a *disciplining effect of the public news dissemination technology*, which makes moderate interest groups report truthful to *all* voters. As voters understand this, they fully trust the message of a moderate interest group. By contrast, a radical interest group has an incentive to always report the same news. Consequently, if voters can identify a radical interest group, they ignore its message and do not update p .

On the voters' side, studying the effects of awareness about the interest group's position z produces an additional interesting insight. As is illustrated in Figure 5, we can divide the electorate into three groups that are affected differently by a change in their awareness of the ideological position of the interest group. There, *stable moderate voters* (with ideological position $Y_1^U < y \leq Y_2^U$) and *stable radical voters* ($y \leq Y_1^A$ and $y > Y_2^A$) are moderate or radical, respectively, in all games.

The novel part refers to *unstable moderate voters* ($Y_1^A < y \leq Y_1^U$ and $Y_2^U < y \leq Y_2^A$), who are moderate in games with awareness but radical in games with unawareness.³³ Without awareness, they prefer a policy that is more extreme than the closest party's policy

$m = -1$, believe that R is acceptable.

³²In the example, the left-favoring interest group would send $m = -1$ to moderate voters and would like to send $m = 1$ to all radicals. The latter, however, is no part of an equilibrium because voters could then infer θ from m_y . Only a mixed strategy solves this dilemma; see equ. (23) and (26).

³³Note that unstable moderate voters only exist if $x_L > y_{\{\mu=0\}}$ or $x_R < y_{\{\mu=1\}}$.

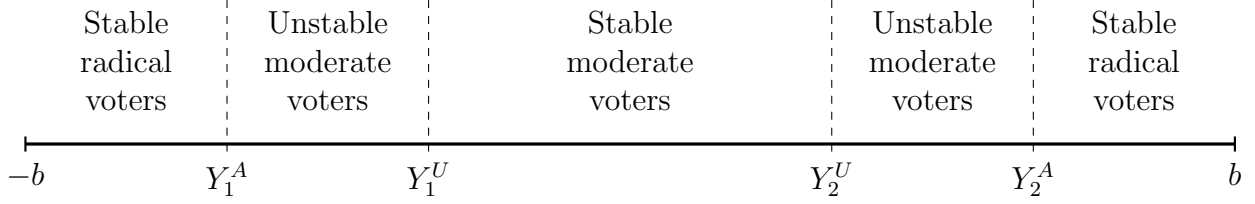


Figure 5: Overview Voter Groups.

position and they firmly prefer their favorite party over the opponent. However, their party-preference changes if they receive convincing evidence that the state of the world is more favorable to the other party: a news report from an identified, moderate interest group has sufficient power of persuasion to them because it is truthful without a shadow of a doubt.³⁴

5 Welfare, Election Flipping, and Competition

5.1 Welfare

A news report that is (partly) trusted serves two functions for voters. First, it informs them whether it is worthwhile to turn out to vote, or not (*cf.*, the (de)mobilization effect of news). Second, it helps moderate voters to find out which party's policy position is closest to their ideal (*cf.*, the persuasion effect of news). A higher degree of trustworthy news and a higher number of voters receiving such news translate into higher total voter welfare (see Section 3.1). In the Appendix, we prove the following proposition:

Proposition 5. (*Voter Welfare*) *In the voter welfare-maximizing equilibria of the four games analyzed, voter welfare compares as follows:*

- (1) *Total voter welfare is strictly higher in public games than in microtargeting games.*
- (2) *Total voter welfare is strictly higher in games with awareness than in games with unawareness.*

Proposition 5 yields the following Corollary:

Corollary 1. (*Voters' Ranking of Games*)

Total voter welfare across the four games ranks as follows:

1. *Public news with Awareness*

³⁴This result suggests an empirical hypothesis: if a polity is characterized by more and more unawareness of voters about interest groups' political positions, e.g. through the proliferation of social media in political news reporting, we expect fewer moderate and more radical voters.

2./3. *Microtargeting with Awareness*

2./3. *Public news with Unawareness*

4. *Microtargeting with Unawareness*

The intuition of Corollary 1, which is a central result of this paper, is straightforward. Because of Proposition 5, public news dissemination and awareness of the interest group's political position maximize voters' welfare. Public news helps *radical* voters benefit from the discipline effect, whereas awareness enables *all* voters to recognize if an interest group is *moderate* (and hence trustworthy) or *radical* (and hence untrustworthy). On the flip-side, voters fare worst under microtargeting and unawareness, where both of these effects do not exist. The ranking of the two intermediate regimes depends on parameter realizations.

5.2 Flipping an Election with Disinformation

The analysis above has shown that manipulating a democratic election is possible, where the extent depends on the dissemination technology and the type of asymmetric information between interest groups and voters. A critical question is whether this effect could be large enough to flip an election, *i.e.*, to change the winner from party L to R , or vice versa.

Here, we only consider non-trivial elections in which the electorate wants to elect party L if $\theta = -1$ and party R if $\theta = 1$. Formally, this restriction means that $\mathbb{E}[\tau_L|\mu = 1] > \mathbb{E}[\tau_R|\mu = 1]$ and $\mathbb{E}[\tau_L|\mu = 0] < \mathbb{E}[\tau_R|\mu = 0]$, where $\mathbb{E}[\tau_L|\mu = 1]$ is the expected voter turnout for party L given that voters are certain that $\theta = -1$, after having received messages. In Lemma A.2, we show that the restriction is met if the following assumption holds:

Assumption 4: $-1 < x_L + x_R < 1$.

This assumption implies that we only consider elections in which party's policy positions are close to symmetric or not too far away from each other.

An interest group successfully flips an election through disinformation if the winning party would have lost the election (i) in the absence of news and (ii) if voters had complete information about the state of the world. Formally:

Definition 1: There is election flipping due to disinformation if the following two conditions hold:

- (1) $\mathbb{E}[\tau_L|p] > \mathbb{E}[\tau_R|p]$ and $\mathbb{E}[\tau_L|m^*(z, \theta), z] < \mathbb{E}[\tau_R|m^*(z, \theta), z]$ if $\theta = -1$.
- (2) $\mathbb{E}[\tau_L|p] < \mathbb{E}[\tau_R|p]$ and $\mathbb{E}[\tau_L|m^*(z, \theta), z] > \mathbb{E}[\tau_R|m^*(z, \theta), z]$ if $\theta = 1$.

The degree to which election flipping is possible depends on (i) the probability that voters are exposed to an interest group with an incentive to flip an election and (ii) the ability of this interest group to actually flip an election.

Regarding (i), the ex-ante probability of exposure to a malevolent interest group is:

$$(1 - p) \frac{x_L + x_R - 2 + 2h}{4h} + p \frac{2h - x_L - x_R - 2}{4h}. \quad (28)$$

This term reflects that only a *radical right* interest group (with ideology $z > \hat{z}$ ($\theta = -1$)) would attempt to flip an election if $\theta = -1$, and only a *radical left* interest group (with ideology $z \leq \hat{z}$ ($\theta = 1$)) has an incentive to flip an election outcome if $\theta = 1$ ((15), Propositions 1-4). While the probability of exposure to a malevolent interest group is the same in all games, the ability of an interest group to flip an election (ii) differs from game to game. We construct a single measure, the *election flipping potential*, to compare an interest group's ability to influence the outcome of an election in its favor across the games.

Definition 2: The *election flipping potential* is defined as the maximum (minimum) prior belief \hat{p} up to which a right-wing (left-wing) interest group can get party R (party L) elected.

We show in the Appendix that the following proposition holds.

Proposition 6. (*Election Flipping*)

- (1) *With voter unawareness, an interest group's election flipping potential is larger in the microtargeting game than in the public game.*
- (2) *Voter unawareness is a necessary condition for election flipping.*

The key insight of Proposition 6 is part (2): as long as voters are aware of an interest group's political position, election flipping is impossible. This insight will be picked up in Section 6.

5.3 Interest Group Competition

In this subsection, we assume that there are $K \geq 1$ interest groups. Each interest group $k \in \{1, \dots, K\}$ has an ideological position, z_k , which is independently and identically drawn from a uniform distribution with support on $[-h, h]$. Each voter receives K messages. We denote by q the number of messages $m = -1$ and by s the number of messages $m = 1$ that a voter receives. Hence, $K = q + s$. The remaining elements of the model, as described in Section 3.1, are kept in place. We prove the following Proposition in the Appendix.

Proposition 7. (*Interest Group Competition*) *Interest group competition increases voter welfare in all games.*

In games with voter unawareness, posterior beliefs of (moderate) voters are as follows:

$$\mu^*(q, s) = \frac{(x_L + x_R + 2h + 2)^q (2h - 2 - x_L - x_R)^s p}{(x_L + x_R + 2h + 2)^q (2h - 2 - x_L - x_R)^s p + (x_L + x_R + 2h - 2)^q (2h + 2 - x_L - x_R)^s (1 - p)} \quad (29)$$

Equation (29) contains a number of insights. First, it is increasing in q , decreasing in s and concave in both q and s . This means that a marginal news report with the same message still affects beliefs but does so at a decreasing rate. Second, conflicting messages do not cancel each other out (meaning that voters' posterior beliefs are not equal to their prior beliefs) unless party positions are symmetric. For instance, suppose that $h - x_R/2h > x_L + h/2h$, meaning that there are more radical right interest groups than radical left interest groups. Receiving a message $m = -1$ (which favors party L) is now more informative about the true state than $m = 1$, which implies that a (moderate) voter weighs the former messages more strongly than the latter. Third, (moderate) voters' beliefs converge to the truth if K increases.³⁵ Fourth, the ratio of radical to moderate voters (weakly) decreases if K increases. The intuition is the same as why there are (weakly) less radical voters in games with voter awareness than games with voter unawareness. One news item might not be enough to persuade voters to change their party preference. However, multiple news items with the same message can.

In equations (18) and (27), we have shown that, in games with voter awareness, a single news item from a moderate interest group is sufficient to resolve all uncertainty about the state of the world for (moderate) voters. Hence, receiving an additional news item from a moderate interest group has no added value for voters. However, the *ex ante* probability that a voter is exposed to news from a moderate interest group increases if K rises. Therefore, voters also benefit from interest group competition in games with voter awareness.

³⁵For instance, consider a game with voter unawareness and parameter values $p = 0.5$, $x_L = -1$, $x_R = 1$ and $h = 3$. Suppose $\theta = -1$. In expectation, a (moderate) voter holds belief $\mathbb{E}[\mu(\cdot) | K = 1] \approx 0.56$ if she receives one message, $\mathbb{E}[\mu(\cdot) | K = 5] \approx 0.76$ if she receives five messages, and $\mathbb{E}[\mu(\cdot) | K = 25] \approx 1$ if she receives 25 messages.

6 Applying the Model Framework

6.1 News Technology and Trust in Political Institutions

For a long time, traditional media such as local newspapers and then TV channels were technologically restricted to send the same political message to all readers or viewers (voters).³⁶ Because of the direct and repeated relationship between sender and receiver, which enabled the interest group to develop a reputation for a certain political position, this situation can be characterized by our *public game with voter awareness*.

Then, in the late 1990s and early 2000s, the first news platforms, including search engines, social media, and news aggregation services, came along (Newman et al., 2017). By design these services could offer automated access to a large number of sources distributing political news quickly. Simultaneously, platform users demonstrate a lack of recognition of the resulting heterogeneity. Kalogeropoulos and Newman (2017) find that digital news consumers are less able to attribute news items to the interest groups that originated them if they saw the news on a platform than if they accessed it directly.³⁷ However, at their start news platforms did neither have the knowledge nor the experience or data analytics tools to structurally exploit the mass of information about preferences and characteristics of billions of users, which are necessary to identify individuals.³⁸ Therefore, this state of news dissemination technology is best characterized by our *public game with voter unawareness*.³⁹

After some years—and certainly since the technological developments of machine learning and especially deep learning in the 2010s (*e.g.*, LeCun, Bengio, and Hinton (2015))—news platforms developed their superior abilities to exploit the gigantic data sets that users supply them with every day by using their services. In turn, voters’ confusion about the precise originator of a specific piece of news has not become smaller. Therefore, today’s situation features high information asymmetry between interest groups and voters. It may be characterized by our *microtargeting game with voter unawareness*.

Survey data indicates that since the early 2000s voters feel less well informed about political matters and trust the news they receive less than before, especially if received via news platforms such as search engines and social media. The Pew Research Center found in 2017 that “Americans have low trust in information from social media. Just 5% of web-using

³⁶Even if national interest groups may have sometimes had regional or even local versions of their content, the latter could only be adjusted to the preferences of voters in that region on average and not to the highly individualized characteristics that today’s major news platforms have access to.

³⁷See the introduction for more details.

³⁸For instance, only in 2001 Google realized that their users’ clicking behavior that is automatically saved in search logs is a valuable source of information (Zuboff, 2019). Two years after this game-changing insight, Google overtook Yahoo as the United States’ leading search engine (Argenton and Prüfer, 2012).

³⁹Potentially, this model also applies to the proliferation of (cable/satellite) TV channels, where viewers had little knowledge about the political orientation of a channel they were watching.

U.S. adults have a lot of trust in the information they get from social media, nearly identical to the 4% who said so in 2016. This level of trust is much lower than trust in national and local news organizations, and in information coming from friends and family.”⁴⁰ Citizens seem to be especially concerned about “fake news” and political disinformation.”⁴¹ In parallel, voters are worried about core national political institutions, such as the U.S. Congress and the Government. Trust in both political institutions has decreased significantly since the early 2000s.⁴² Interestingly though, despite the reported distrust, social media are vastly used, also for news consumption while the shares of prime TV and print media users have shrunk over the past years.⁴³

Bringing both the evolution of political news dissemination technology and the media consumption patterns and doubts of the U.S. citizenry together, the model framework introduced and analyzed above can rationalize these joint developments. The key argument is that technological progress over the past 25 years has enabled political interest groups to disseminate their strategic messages about the state of the world at a more microtargeted level. In parallel, the rise of news platforms has significantly advanced the unawareness of voters about news’ originators, which reduces their ability to put news contents into perspective. As joint phenomena, both developments can rationalize that voters with moderate political views discount the credibility of all news they see online (apart from a few highly reputable media outlets with known political positions) and that voters with more radical views even disregard all news when forming their beliefs about the state of the world. These developments can have serious consequences for the future of democracy (see also Thomassen (2015)). What, if anything, could be done about it?

6.2 Policy Proposals

Ban microtargeting: Our model suggests that, starting from a world with *microtargeting and unawareness*, if it were possible to prohibit microtargeting (and go back to the *public game with unawareness*), the informativeness of political news would increase and the potential to manipulate elections by spreading disinformation would decrease due to the disciplining effect of public news dissemination. This would benefit radical voters, who, in our model, do not receive informative news if microtargeting is possible.

⁴⁰<https://www.pewresearch.org/fact-tank/2017/10/04/key-trends-in-social-and-digital-news-media/>

⁴¹<https://www.journalism.org/2016/12/15/many-americans-believe-fake-news-is-sowing-confusion/>.

⁴²Sources: https://cdn1.vox-cdn.com/uploads/chorus_asset/file/5658601/Figure_1___2_.0.png and <http://assets.pewresearch.org/wp-content/uploads/sites/5/2015/11/Trust-8.png>.

⁴³See <https://www.journalism.org/2019/03/26/nearly-as-many-americans-prefer-to-get-their-local-news-online-as-prefer-the-tv-set/> and <https://www.pewresearch.org/fact-tank/2018/12/10/social-media-outpaces-print-newspapers-in-the-u-s-as-a-news-source>.

However, the interest group’s (and the platform’s) payoff would shrink. Should microtargeting be banned, such a legal provision would be hard to enforce.⁴⁴ Most important, the positive effects of microtargeting would be ignored: As known for long in the advertisement industry, some consumers like to see advertisements that fit their product tastes, while others are skeptical, especially when they perceive advertisements to be obtrusive.⁴⁵

In sum, there are good reasons to ban microtargeting but the case is difficult, hard to enforce, and its net effects on welfare are ambiguous and require further research.

Require minimum numbers of receivers getting the same message: Compared to banning microtargeting completely, it may be easier and more efficient to follow a proposal of the UK’s House of Commons (2018). Their *Digital, Culture, Media and Sport Committee* suggests “a minimum limit for the number of voters sent individual political messages [...] at a national level” (paragraph 142). Consequently, voters could not be targeted individually but interest groups would have to send a similar message at least to the minimum number of voters set by that committee.

The problem with this proposal is illustrated by the interest group’s equilibrium strategy in games with microtargeting, especially if it coincides with voter unawareness (Proposition 3). There, we show that even with our most limited message space of $\{-1, 1\}$ it is possible to manipulate an election. If the number of moderate and radical voters were equal, an interest group could even make use of its full election flipping potential and still manipulate or even flip an election. Customization of the message content at the individual level is not necessary as long as every voter can be attributed to a certain group with homogeneous characteristics and this group is not too small. Therefore, it would be possible to both comply with the House of Commons’ proposal and to effectively deceive voters and manipulate an election.

Competition among interest groups: As shown in Section 5.3, increasing the number of messages from various interest groups seen by a voter increases voter welfare and benefits especially moderate voters. Therefore, our model supports efforts to increase (or, at least, retain) media plurality and to keep competition for voters’ attention lively. However, our model assumed that the messages received by a given voter would be a random draw from all available messages, which ignores echo chamber effects and demand-driven media bias. Moreover, we did not explicitly model voters’ limited attention span, which mitigates the positive effects of seeing many messages in practice.

⁴⁴A public authority (for instance, a data protection authority or a competition authority) would face the enormous task to understand and regulate the algorithms used by news platforms, a highly complex task.

⁴⁵See Goldfarb and Tucker (2011) for a discussion of this literature.

Reestablishing awareness about interest group’s political position: What could be more effective, is to *reestablish awareness* among voters about the political position of the sender of a specific message. Thereby, from today’s situation we would move to the *microtargeting game with voter awareness* (see Proposition 4). Especially moderate voters would benefit from such a regime change: without awareness, they discount informative news somewhat and do take uninformative news into account when forming opinions about the state of the world. With awareness, however, they could distinguish clearly between sender types: radical interest groups do not send informative news in equilibrium and can, hence, be disregarded, whereas moderate interest groups report truthfully to moderate voters, which makes their messages informative. According to our model, radical voters would not benefit from a move to awareness alone as long as they can still be microtargeted. However, as our results in Sections 5.1 and 5.2 show, at the aggregate voter level reestablishing awareness could substantially decrease voter disinformation and the risk of election manipulation.

The problem stemming from voters’ unawareness is closely associated with the rise of news platforms, which source their distributed news from many different original news providers and thereby lead to voters’ confusion or ignorance about the original source. A straightforward measure to help re-establishing awareness would be to restrict (algorithmic) news aggregation or the dissemination of political news via social media altogether. However, such a drastic policy would simultaneously hurt many users of these services, which seem to get benefits from news platforms.⁴⁶

Therefore, a more practical proposal may not be to force news platforms to change their business model or to ban them from microtargeting users but to *compel them to implement technologies by which users can easily recognize the identity of a specific message’s original sender*.⁴⁷ This should help users/voters to assess the political position of a news item’s originator, resembling our game with microtargeting and awareness.⁴⁸ If this were possible, voters could, with reasonable additional effort, update beliefs about the credibility of the news received and make voting decisions that are more aligned with their own interest.⁴⁹

⁴⁶https://www.cjr.org/tow_center/tech-innovations-local-news.php

⁴⁷Whether this works best via small icons shown next to each message or by some other easy-to-understand signaling system is subject to further research, probably involving psychology, political science, and computer science. At a recent conference, Google’s chief economist, Hal Varian, speculated that reliable information providers on social media might soon sign their messages by digital signatures (personal identifiers) to establish credibility.

⁴⁸For an example that moves in the direction of such a policy, see footnote 14.

⁴⁹Another proposal is *fact checking*, where external organizations check the truthfulness and accuracy of news items that interest groups have reported. This proposal suffers from several shortcomings. First, false messages have higher circulation and are read more often than correct messages (Vosoughi, Roy, and Aral, 2018), making it very hard to identify all disinformation quickly. Second, even if all disinformation *could* be identified, it would be prohibitively costly to check every message with political content, given the low cost to produce such messages, including those by automated bots. Third, it is very hard to reach all receivers of disinformation. Guess, Nyhan, and Reifler (2018) found that fact-checks of false

7 Conclusion

Two developments in dissemination technologies have crucially influenced citizens’ consumption patterns of political news over the past decades. First, big data about billions of users’ preferences and characteristics and data analytics methods employing machine learning algorithms have enabled news platforms to identify and to target ever smaller groups of users. News platforms can—and often do as part of their business model—sell this microtargeted access to third parties, including political interest groups. Second, voters using platforms for various purposes, are swamped with messages, including many with political subject matters. This can lead to voters having difficulties associating the content of a specific message with the original sender of this message, its political position and, hence, its likely intentions.

Our model framework has allowed us to isolate the effects of a switch from public news dissemination to microtargeting, and from voters’ awareness about the political position of an interest group to voters’ unawareness. We have shown that both microtargeting and voters’ unawareness hurt the degree of information of voters and their total welfare. Crucially, while problems surrounding microtargeting have resulted in various policy proposals intending to ban the technique in practice, we have shown that voters’ unawareness about an interest group’s political position is more severe: microtargeting alone can help to manipulate an election by a few percentage points but only unawareness can completely switch an election (to change the winning party).

Our model generates some of its more worrying results despite the fact that we assume perfectly rational voters without cognitive constraints. In practice, many voters are subject to various biases and limitations, possibly aggravating the negative effects we point out. Moreover, as we have identified the dangers stemming from news consumption on online platforms, including social media, it is particularly concerning that social media consumption is especially high among vulnerable groups.⁵⁰ Informed by our theoretical analysis, we discuss several policy proposals that could potentially mitigate the negative effects of microtargeting and voter unawareness of the originators of news items.

Our findings point at the role of increasing *media literacy* (see JMLE.org). Informing (prospective) voters about the mechanisms and possible intentions of news reporting can be

messages almost never reach their readers. Fourth, flagging fact-checked news items that contain false information might have an ‘implied truth effect’, meaning that unflagged disinformation might be seen as more accurate by news consumers (Pennycook et al., 2020). Implicit evidence, that fact checking is extremely difficult to implement, was given by Mark Zuckerberg, who claimed that Facebook removes one million fake accounts every day and that a team of 35,000 employees works on reviewing potentially harmful content <https://www.euronews.com/2020/02/15/zuckerberg-tells-europe-regulate-soon-or-authoritarian-china-will-set-the-rules-on-social>.

⁵⁰ “Social media news use also increased to 69% in 2017 among those with less than a bachelor’s degree, surpassing those with a college degree or higher (63%).” See <https://www.pewresearch.org/fact-tank/2017/10/04/key-trends-in-social-and-digital-news-media/>

an important step to become more skeptical and less naive. However, since our model assumes perfectly rational voters—and showed that they can still be manipulated—, increasing media literacy is no substitute for the more promising policies we discussed above.

Our model relies on stylized assumptions. On the theoretical side, some authors have argued that confirmation bias (Plous, 1993) is a relevant phenomenon among voters, which might be included in our framework in future research. Similarly, deviations from the randomized draws and uniform distribution of messages, especially on the news platform’s side (platform bias) and on the voters’ side (endogenous news consumption) are promising directions for the future.⁵¹ This requires further empirical work and tests to assess to which extent these assumptions are acceptable simplifications of reality. Among the most pressing questions are: To which extent do people fall prey to disinformation about politically relevant events depending on the information they have about interest group’s political position? To which extent can political interest groups actually make use of this weakness and manipulate election outcomes? To get clean results, such empirical testing may first be conducted employing experimental studies. Then, to verify the external validity of lab results, they should be tested in the field. A lot of future work is waiting.

⁵¹Both characteristics were suggested by Piolatto and Schuett (2015).

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A Appendix

Proof of Proposition 1

Before proving Proposition 1, we prove the following lemma.

Lemma A.1. *Party L 's vote share, ν_L , is increasing in $\mu(\cdot)$ if all voters hold identical beliefs.*

Proof of Lemma A.1. We begin by showing that party L 's turnout, $\tau_L(a)$, increases in $\mu(\cdot)$. Given that all voters have belief μ' , party L 's turnout is as follows:

$$\tau_L(a) = \int_{-b}^{\hat{y}_{\{\mu'\}}} \frac{\mathbb{E}[U(a = L, y, \theta) | \mu']}{2b\bar{c}} dy. \quad (\text{A.1})$$

We use (8), integrate (A.1), and take its derivative with respect to μ . This yields

$$\begin{aligned} \frac{d\tau_L}{d\mu} &= \frac{\mathbb{E}[U(a = L, \hat{y}_{\{\mu'\}}, \theta) | \mu'] - t(x_L + b)^2 + t(\hat{y}_{\{\mu'\}} - x_L)^2}{b\bar{c}} \\ &= \frac{g - t - 2t(2\mu' - 1)\left(\frac{x_L - x_R}{2} - 2\mu' + 1\right) - t(x_L + b)^2}{b\bar{c}}, \end{aligned} \quad (\text{A.2})$$

which is strictly positive if the following inequality holds:

$$g > t + 2t(2\mu' - 1)\left(\frac{x_L - x_R}{2} - 2\mu' + 1\right) + t(x_L + b)^2. \quad (\text{A.3})$$

The right-hand side of (A.3) is maximized for

$$\mu' = \frac{4 - x_R + x_L}{8}. \quad (\text{A.4})$$

Plugging (A.4) into (A.3) gives us

$$g > t + \frac{t(x_R - x_L)^2}{8} + t(x_L + b)^2, \quad (\text{A.5})$$

which always holds under Assumptions 1 and 2. Hence, $\tau_L(a)$ increases in $\mu(\cdot)$ for any μ' .

We now show that party R 's turnout, $\tau_R(a)$, decreases in $\mu(\cdot)$. Given that all voters have belief μ' , party R 's turnout is:

$$\tau_R(a) = \int_{\hat{y}_{\{\mu'\}}}^b \frac{\mathbb{E}[U(a = R, y, \theta) | \mu']}{2b\bar{c}} dy. \quad (\text{A.6})$$

We use (8), integrate (A.6), and take its derivative with respect to μ . This gives us

$$\begin{aligned}\frac{d\tau_R}{d\mu} &= \frac{-\mathbb{E}[U(a = R, \hat{y}_{\{\mu'\}}, \theta) | \mu'] + t(b - x_R)^2 - t(x_R - \hat{y}_{\{\mu'\}})^2}{b\bar{c}} \\ &= \frac{-g + t + 2t(2\mu' - 1)\left(\frac{x_R - x_L}{2} - 2\mu' + 1\right) + t(b - x_R)^2}{b\bar{c}},\end{aligned}\quad (\text{A.7})$$

which is strictly negative if the following holds:

$$g > t + 2t(2\mu' - 1)\left(\frac{x_R - x_L}{2} - 2\mu' + 1\right) + t(b - x_R)^2. \quad (\text{A.8})$$

The right-hand side of (A.8) is maximized for

$$\mu' = \frac{4 + x_R - x_L}{8}. \quad (\text{A.9})$$

Plugging (A.9) into (A.8) gives us

$$g > t + \frac{t(x_R - x_L)^2}{8} + t(b - x_R)^2, \quad (\text{A.10})$$

which always holds under Assumptions 1 and 2. Hence, $\tau_R(a)$ decreases in $\mu(\cdot)$ for any μ' .

Since $d\nu_L(a)/d\tau_L(a) > 0$ and $d\nu_L(a)/d\tau_R(a) < 0$ (14), party L 's vote share $\nu_L(a)$ is increasing in $\mu(\cdot)$:

$$\frac{d\nu_L(a)}{d\mu} > 0. \quad (\text{A.11})$$

□

Proof of Proposition 1. Each voter maximizes her expected utility, given her belief $\mu(m)$, by voting for party $j \in \{L, R\}$ if IC_j (see (9),(10)) and PC_j (11) hold, and by abstaining from voting otherwise (16). The interest group reports $m = -1$ if it favors party L and $m = 1$ if it favors party R (see (15) and (20)). As depicted in Figure (1), it depends on the state of the world which party the interest group favors if $\hat{z}(\theta = 1) < z \leq \hat{z}(\theta = -1)$. The group's favorite party is state-independent if $z \leq \hat{z}(\theta = 1)$ or $z > \hat{z}(\theta = -1)$. Hence, following Bayes' rule, voters have the posterior beliefs specified in (18). Conditional on the interest group's ideology being $\hat{z}(\theta = 1) < z \leq \hat{z}(\theta = -1)$, voters assign a higher probability to $\theta = -1$ if $m = -1$ than if $m = 1$. As a result, the indifferent voter is located further to the right of the political spectrum for $m = -1$ than $m = 1$ (8), as can be seen from Figure (2). Under Assumptions 1 and 2, $\nu_L(a)$ is increasing in $\hat{y}(\cdot)$ (Lemma (A.1)), which implies that the interest group has no incentive to deviate from its reporting strategy if $\hat{z}(\theta = 1) < z \leq \hat{z}(\theta = -1)$. We can construct voters' out-of-equilibrium beliefs in such a

way that $\mu(m = -1, z \leq \hat{z}(\theta = 1)) \leq p$ and $\mu(m = 1, z > \hat{z}(\theta = -1)) \geq p$, which provides the interest group no incentive to deviate for $z \leq \hat{z}(\theta = 1)$ and $z > \hat{z}(\theta = -1)$. Since $\mu^*(m = -1) > \mu^*(m = 1)$ for $\hat{z}(\theta = 1) < z \leq \hat{z}(\theta = -1)$, news reporting is informative in equilibrium. Thus, we can conclude that the game has an informative equilibrium in which the interest group follows the reporting strategy stated in (17) and voters choose their best voting actions and update their beliefs according to (16) and (18).

Restricting ourselves to equilibria in which $\mu^*(m = -1) \geq \mu^*(m = 1)$ for all voters, no other informative equilibrium exists since an interest group with ideology $\hat{z}(\theta = 1) < z \leq \hat{z}(\theta = -1)$ has an incentive to report $m = -1$ if $\theta = -1$ and $m = 1$ if $\theta = 1$ in any equilibrium in which $\mu(m = -1, \hat{z}(\theta = 1) < z \leq \hat{z}(\theta = -1)) > \mu(m = 1, \hat{z}(\theta = 1) < z \leq \hat{z}(\theta = -1))$. It then follows from Bayes' rule that beliefs are as specified in (18). An equilibrium with $\mu(m = -1, z) > \mu(m = 1, z)$ for $z \leq \hat{z}(\theta = 1)$ or $z > \hat{z}(\theta = -1)$ cannot exist, as it would induce the interest group to report the same news item in both states, such that voters' beliefs are inconsistent with the interest group's reporting behavior.

What remains to be shown is that the informative equilibrium is also voter welfare-maximizing. Since only one informative equilibrium exists, we need to show that voter welfare is higher in this equilibrium than in the babbling equilibrium (in which $\mu^*(m = -1) = \mu^*(m = 1) = p$). The expected payoffs of a voter with ideology y are as follows in a babbling equilibrium:

$$\mathbb{E}[U(a, y, \theta) | p] = \begin{cases} \frac{\mathbb{E}[U(a=L, y, \theta) | p]}{\bar{c}} \left(\mathbb{E}[U(a = L, y, \theta) | p] - \int_0^{\mathbb{E}[U(a=L, y, \theta) | p]} \frac{c_y}{\mathbb{E}[U(a=L, y, \theta) | p]} dc_y \right) \\ \text{if } y \leq y_{\{\mu=p\}} \\ \frac{\mathbb{E}[U(a=R, y, \theta) | p]}{\bar{c}} \left(\mathbb{E}[U(a = R, y, \theta) | p] - \int_0^{\mathbb{E}[U(a=R, y, \theta) | p]} \frac{c_y}{\mathbb{E}[U(a=R, y, \theta) | p]} dc_y \right) \\ \text{if } y > y_{\{\mu=p\}}, \end{cases} \quad (\text{A.12})$$

where the first term (outside the brackets) is the probability that voter y turns out to vote, the second term is her expected utility from voting for party $j \in \{L, R\}$, and the third term is her expected cost of voting, conditional on turning out to vote for party j .

We now look at the gain in expected payoffs for voter y from moving from the babbling equilibrium to the informative equilibrium. Without loss of generality, we consider the case that voter y receives message $m = -1$.

The gain is as follows for a voter with ideology $y \leq \min\{x_L, \hat{y}_{\{p\}}\}$:

$$\begin{aligned}
& \frac{\mathbb{E}[U(a = L, y, \theta) | p] - \mathbb{E}[U(a = L, y, \theta) | \mu(m = -1)]}{\bar{c}} \\
& \times \left(\int_{\mathbb{E}[U(a=L, y, \theta) | \mu(m=-1)]}^{\mathbb{E}[U(a=L, y, \theta) | p]} \frac{c_y}{\mathbb{E}[U(a = L, y, \theta) | p] - \mathbb{E}[U(a = L, y, \theta) | \mu(m = -1)]} dc_y \right. \\
& \left. - \mathbb{E}[U(a = L, y, \theta) | \mu(m = -1)] \right), \tag{A.13}
\end{aligned}$$

which is strictly positive because $\mu(m = -1) > p$ and $U(a = L, y, \theta = -1) < U(a = L, y, \theta = 1)$ for $y \leq \min\{x_L, \hat{y}_{\{p\}}\}$.

The gain from news is as follows for a voter with ideology $x_L < y < \hat{y}_{\{p\}}$:

$$\begin{aligned}
& \frac{\mathbb{E}[U(a = L, y, \theta) | \mu(m = -1)] - \mathbb{E}[U(a = L, y, \theta) | p]}{\bar{c}} \\
& \times \left(\mathbb{E}[U(a = L, y, \theta) | \mu(m = -1)] \right. \\
& \left. - \int_{\mathbb{E}[U(a=L, y) | p]}^{\mathbb{E}[U(a=L, y, \theta) | \mu(m=-1)]} \frac{c_y}{\mathbb{E}[U(a = L, y, \theta) | \mu(m = -1)] - \mathbb{E}[U(a = L, y) | p]} dc_y \right), \tag{A.14}
\end{aligned}$$

which is strictly positive because $\mu(m = -1) > p$ and $U(a = L, y, \theta = -1) > U(a = L, y, \theta = 1)$ for $x_L < y < \hat{y}_{\{p\}}$.

The gain is as follows for a voter with ideology $\hat{y}_{\{p\}} < y \leq \hat{y}_{\{\mu_2\}}$:

$$\begin{aligned}
& \frac{\mathbb{E}[U(a = L, y, \theta) | \mu(m = -1)]}{\bar{c}} \left(\mathbb{E}[U(a = L, y, \theta) | \mu(m = -1)] \right. \\
& \left. - \int_0^{\mathbb{E}[U(a=L, y, \theta) | \mu(m=-1)]} \frac{c_y}{\mathbb{E}[U(a = L, y, \theta) | \mu(m = -1)]} dc_y \right) \\
& - \frac{\mathbb{E}[U(a = R, y, \theta) | p]}{\bar{c}} \left(\mathbb{E}[U(a = R, y, \theta) | \mu(m = -1)] - \right. \\
& \left. \int_0^{\mathbb{E}[U(a=R, y, \theta) | p]} \frac{c_y}{\mathbb{E}[U(a = R, y, \theta) | p]} dc_y \right), \tag{A.15}
\end{aligned}$$

which is strictly positive because $\mu(m = -1) > p$ and $U(a = L, y, \theta = -1) > U(a = R, y, \theta = -1)$ for $\hat{y}_{\{p\}} < y \leq \hat{y}_{\{\mu_2\}}$.

The gain is as follows for a voter with ideology $\hat{y}_{\{\mu_2\}} < y < x_R$:

$$\begin{aligned} & \frac{\mathbb{E}[U(a = R, y, \theta) | p] - \mathbb{E}[U(a = R, y, \theta) | \mu(m = -1)]}{\bar{c}} \\ & \times \left(\int_{\mathbb{E}[U(a=R, y, \theta) | \mu(m=-1)]}^{\mathbb{E}[U(a=R, y, \theta) | p]} \frac{c_y}{\mathbb{E}[U(a = R, y, \theta) | p] - \mathbb{E}[U(a = R, y, \theta) | \mu(m = -1)]} dc_y \right. \\ & \left. - \mathbb{E}[U(a = R, y, \theta) | \mu(m = -1)] \right), \end{aligned} \quad (\text{A.16})$$

which is strictly positive because $\mu(m = -1) > p$ and $U(a = R, y, \theta = -1) < U(a = R, y, \theta = 1)$ for $\hat{y}_{\{\mu_2\}} < y < x_R$.

The gain is as follows for a voter with ideology $y > \max\{x_R, \hat{y}_{\{\mu_2\}}\}$:

$$\begin{aligned} & \frac{\mathbb{E}[U(a = R, y, \theta) | \mu(m = -1)] - \mathbb{E}[U(a = R, y, \theta) | p]}{\bar{c}} \\ & \times \left(\mathbb{E}[U(a = R, y, \theta) | \mu(m = -1)] \right. \\ & \left. - \int_{\mathbb{E}[U(a=R, y, \theta) | p]}^{\mathbb{E}[U(a=R, y, \theta) | \mu(m=-1)]} \frac{c_y}{\mathbb{E}[U(a = R, y, \theta) | \mu(m = -1)] - \mathbb{E}[U(a = R, y, \theta) | p]} dc_y \right), \end{aligned} \quad (\text{A.17})$$

which is strictly positive because $\mu(m = -1) > p$ and $U(a = R, y, \theta = -1) > U(a = R, y, \theta = 1)$ for $y > \max\{x_R, \hat{y}_{\{\mu_2\}}\}$.

Thus, we can conclude that the informative equilibrium we found is the voter welfare-maximizing equilibrium. □

Proof of Proposition 2

Proof. A voter's best voting action (19) and the interest group's reporting strategy (20) are the same as in the public game with voter awareness (see (16) and (17)). Under Assumption 3, the interest group is more likely to favor party L if $\theta = -1$ than if $\theta = 1$, as is illustrated in Figure 1. For this reason, voters assign a higher probability to $\theta = -1$ if they receive news item $m = -1$ instead of $m = 1$ (21). The ideological position of the indifferent voter lies further to the right of the spectrum if $m = -1$ than if $m = 1$, which implies that party

L gets a larger vote share if $m = -1$ ((8) and Lemma A.1). Since the interest group only reports $m = -1$ if it favors party L (20), no interest group type has an incentive to deviate. Thus, there is an equilibrium in which the interest group follows the strategy stated in (20) and the voters choose their voting action and update their beliefs according to (19) and (21).

The equilibrium is informative since $\mu^*(m = -1) > p > \mu^*(m = 1)$ for each voter. Restricting ourselves to equilibria in which $\mu^*(m = -1) \geq \mu^*(m = 1)$ for all voters, no other informative equilibrium exists. In any equilibrium in which

$\mu(m = -1, \hat{z}(\theta = 1) < z \leq \hat{z}(\theta = -1)) > \mu(m = 1, \hat{z}(\theta = 1) < z \leq \hat{z}(\theta = -1))$, an interest group with ideology $\hat{z}(\theta = 1) < z \leq \hat{z}(\theta = -1)$ has an incentive to report $m = -1$ if $\theta = -1$ and $m = 1$ if $\theta = 1$. It then follows from Bayes' rule that beliefs are as specified in (18). An equilibrium with $\mu(m = 1, z) > \mu(m = -1, z)$ for $z \leq \hat{z}(\theta = 1)$ or $z > \hat{z}(\theta = -1)$ cannot exist, as it would induce the interest group to report the same news item in both states, such that voters' beliefs are inconsistent with the interest group's reporting behavior.

What remains to be shown is that the informative equilibrium is also voter welfare-maximizing. Since only one informative equilibrium exists, we need to show that voter welfare is higher in this equilibrium than in the babbling equilibrium (in which $\mu^*(m = -1) = \mu^*(m = 1) = p$). The expected payoffs of a voter y in the babbling equilibrium are given in equ. (A.12). We now look at the gain in expected payoffs for voter y from moving from the babbling equilibrium to the informative equilibrium. Without loss of generality, we consider the case that voter y receives message $m = -1$. The gain for voter y is given in equations (A.13)-(A.17). Since each voter y has a strictly positive gain, we can conclude that the informative equilibrium we found is the voter welfare-maximizing equilibrium. □

Proof of Proposition 3

Proof. For the same reasons as detailed in the proof of Proposition 1, voters' best voting action (22) is the same as in the public games (see (16) and (19)). Reacting to that strategy, the interest group reports $m = -1$ if it favors party L and $m = 1$ if it favors party R to voters with ideological position $Y_1^U < y \leq Y_2^U$ (23), where

$$Y_1^U = \min\{x_L, \hat{y}_{\{\mu_1\}}\} \tag{A.18}$$

and

$$Y_2^U = \max\{x_R, \hat{y}_{\{\mu_2\}}\}. \tag{A.19}$$

Assumption 3 guarantees that the interest group is more likely to favor party L if $\theta = -1$ than if $\theta = 1$, as depicted in Figure 1. Hence, voters with ideology $Y_1^U < y \leq Y_2^U$ assign

a higher probability to $\theta = -1$ if $m_y = -1$ than if $m_y = 1$ according to Bayes' rule (24). The interest group engages in state-independent reporting to voters with ideology $y \leq Y_1^U$ or $y > Y_2^U$ (23), such that application of Bayes' rule induces these voters to ignore news (24). There is no incentive to deviate from its reporting behavior to voters with ideology $y \leq Y_1^U$ and $y > Y_2^U$ because both news items evoke the same beliefs and, hence, the same voting behavior among these voters. The interest group also cannot gain by changing its reporting behavior to the rest of the electorate. For voters with ideology $\hat{y}_{\{\mu_1\}} < y < \hat{y}_{\{\mu_2\}}$ it is, respectively, incentive compatible to vote for party L if $m_y = -1$ and party R if $m_y = 1$ (see (8),(9),(10), (22)), as is depicted in Figure 3a. Thus, the interest group cannot increase its expected payoff by deviating from its reporting behavior for this group of voters. If $x_L < \hat{y}_{\{\mu_1\}}$, there are voters with ideology $x_L < y < \hat{y}_{\{\mu_1\}}$, for whom it is always incentive compatible to vote for party L (see (8),(9),(24)), which is illustrated in Figure 3b. Their PC_L , however, is more likely to be satisfied for $m_y = -1$ than $m_y = 1$ ((2),(11),(24)). Since the interest group only reports $m_y = -1$ for $x_L < y < \hat{y}_{\{\mu_1\}}$ if party L is its favorite party and $m_y = 1$ otherwise, the interest group cannot gain by changing its reporting behavior for these voters. From figure 3b, we can also see that it is always incentive compatible for voters with ideology $\hat{y}_{\{\mu_2\}} < y < x_R$ to vote for party R . For this voter group, PC_R is more likely to hold for $m_y = 1$ than $m_y = -1$ ((2),(11),(24)). Hence, the interest group can also not improve upon its reporting behavior to these voters, which is reporting $m_y = -1$ if it favors party L and $m_y = 1$ if it favors party R (23). Therefore, the game has an informative equilibrium in which players follow the strategies described in (22) and (23) and voters update beliefs according to (24).

Restricting ourselves to equilibria in which $\mu^*(m_y = -1) \geq \mu^*(m_y = 1)$ for all voters, no other informative equilibrium exists. In any equilibrium with $\mu^*(m_y = -1) > \mu^*(m_y = 1)$ for $Y_1^U < y \leq Y_2^U$, the interest group maximizes its expected payoff by reporting as described in (23). It then follows from Bayes' rule that beliefs of voters with ideology $Y_1^U < y \leq Y_2^U$ are determined according to (24). News cannot be informative to voters with ideology $y \leq Y_1^U$ and $y > Y_2^U$. If $\mu(m_y = -1) > \mu(m_y = 1)$ for $y \leq Y_1^U$ or $y > Y_2^U$, the interest group would have an incentive to report $m_y = 1$ if $z \leq \hat{z}(\theta)$ and $m_y = -1$ if $z > \hat{z}(\theta)$. This implies that voters with ideology $y \leq Y_1^U$ and $y > Y_2^U$ would be *more* likely to receive $m_y = -1$ if $\theta = 1$ than if $\theta = -1$, which makes the reporting behavior inconsistent with voters' beliefs.

What remains to be shown is that the informative equilibrium is also voter welfare-maximizing. Since only one informative equilibrium exists, we need to show that voter welfare is higher in this equilibrium than in the babbling equilibrium (in which $\mu^*(m = -1) = \mu^*(m = 1) = p$). The expected payoffs of a voter y in the babbling equilibrium are given in equ. (A.12). We now look at the gain in expected payoffs for voter y from moving from the babbling equilibrium to the informative equilibrium. Without loss of generality, we consider

the case that voter y receives message $m_y = -1$.

The gain for a voter with ideology $Y_1^U < y \leq Y_2^U$ is given in equations (A.14)-(A.16) and is (weakly) positive. A voter with ideology $y \leq Y_1^U$ or $y > Y_2^U$ is exactly well-off with and without news because news is uninformative to her ($\mu(m_y = -1) = \mu(m_y = 1) = p$ for $y \leq Y_1^U$ and $y > Y_2^U$).

Since each voter y has a (weakly) positive gain, we can conclude that the informative equilibrium we found is the voter welfare-maximizing equilibrium. □

Proof of Proposition 4

Proof. The best voting action (see (25)) remains unchanged, as compared to the previously analyzed games (see (16), (19), and (22)). The interest group's reporting strategy (26) is the same as in the microtargeting game (23). Voters with ideology $Y_1^A < y \leq Y_2^A$ receive *state-dependent* news if the interest group has ideology $\hat{z}(\theta = 1) < z \leq \hat{z}(\theta = -1)$ and *state-independent* news otherwise. Voters with ideology $y \leq Y_1^A$ or $y > Y_2^A$ always receive state-independent news. Thus, following Bayes' rule, voters' posterior beliefs are determined according to (27).

To prove that the strategy profiles and beliefs in (25), (26), and (27) constitute an equilibrium, we now need to show that the interest group has no incentive to deviate from its reporting strategy.

For voters with ideology $y \leq Y_1^A$ and $y > Y_2^A$, the interest group always induces the same posterior beliefs (27) regardless of the news it sends and, hence, has no incentive to deviate from its reporting behavior to these voters (26). In the proof of Proposition 3, we established that if voters with ideology $Y_1^A < y \leq Y_2^A$ assign a *higher* probability to $\theta = -1$, the interest group achieves a *higher* expected payoff for $z \leq \hat{z}(\theta)$ and a *lower* expected utility for $z > \hat{z}(\theta)$. Thus, the interest group has no incentive to deviate from its reporting behavior if $\hat{z}(\theta = 1) < z \leq \hat{z}(\theta = -1)$ ((26) and (27)). If we construct voters' out-of-equilibrium beliefs such that $\mu(m_y = -1, z \leq \hat{z}(\theta = 1)) \leq p$ and $\mu(m_y = 1, z > \hat{z}(\theta = -1)) \geq p$, the interest group also cannot gain from changing its equilibrium reporting behavior for $z \leq \hat{z}(\theta = 1)$ and $z > \hat{z}(\theta = -1)$. Hence, there is an informative equilibrium in which voters choose their best voting actions based on (25) and update their beliefs according to (27), and in which the interest group follows the strategy described in (26).

Restricting ourselves to equilibria in which $\mu^*(m_y = -1) \geq \mu^*(m_y = 1)$ for all voters, no other informative equilibrium exists. In any equilibrium with $\mu^*(m_y = -1) > \mu^*(m_y = 1)$ for $Y_1^U < y \leq Y_2^U$, the interest group maximizes its expected payoff by reporting as described in (26). It then follows from Bayes' rule that beliefs of voters with ideology $Y_1^U < y \leq Y_2^U$ are determined according to (27). News cannot be informative to voters with ideology $y \leq Y_1^U$

and $y > Y_2^U$. If $\mu(m_y = -1) > \mu(m_y = 1)$ for $y \leq Y_1^U$ or $y > Y_2^U$, the interest group would have an incentive to report $m_y = 1$ if $z \leq \hat{z}(\theta)$ and $m_y = -1$ if $z > \hat{z}(\theta)$. This implies that voters with ideology $y \leq Y_1^U$ and $y > Y_2^U$ would be *more* likely to receive $m_y = -1$ if $\theta = 1$ than if $\theta = -1$, which makes the reporting behavior inconsistent with voters' beliefs.

What remains to be shown is that the informative equilibrium is also voter welfare-maximizing. Since only one informative equilibrium exists, we need to show that voter welfare is higher in this equilibrium than in the babbling equilibrium (in which $\mu^*(m = -1) = \mu^*(m = 1) = p$). The expected payoffs of a voter y in the babbling equilibrium are given in equ. (A.12). We now look at the gain in expected payoffs for voter y from moving from the babbling equilibrium to the informative equilibrium. Without loss of generality, we consider the case that voter y receives message $m_y = -1$.

The gain for a voter with ideology $Y_1^A < y \leq Y_2^A$ is given in equations (A.14)-(A.16) and is (weakly) positive. A voter with ideology $y \leq Y_1^A$ or $y > Y_2^A$ is exactly well-off with and without news because news is uninformative to her ($\mu(m_y = -1) = \mu(m_y = 1) = p$ for $y \leq Y_1^A$ and $y > Y_2^A$).

Since each voter y has a (weakly) positive gain, we can conclude that the informative equilibrium we found is the voter welfare-maximizing equilibrium. □

Proof of Proposition 5

Proof. (1) Voters with ideology $Y_1^A < y \leq Y_2^A$ have exactly the same strictly positive payoff gains moving from the babbling equilibrium to the informative equilibrium in the public game with awareness and the microtargeting game with awareness (see Propositions 1 and 4 and equations (A.12)-(A.17)). Voters with ideology $y \leq Y_1^A$ and $y > Y_2^A$, however, have strictly positive payoff gains from moving the babbling equilibrium to the informative equilibrium in the public game with awareness but are equally well-off in the babbling equilibrium and the informative equilibrium in the microtargeting game with awareness (see Propositions 1 and 4 and equations (A.12)-(A.17)).

Similarly, voters with ideology $Y_1^U < y \leq Y_2^U$ have exactly the same strictly positive payoff gains moving from the babbling equilibrium to the informative equilibrium in the public game with unawareness and the microtargeting game with unawareness (see Propositions 2 and 3 and equations (A.12), (A.14)-(A.16)). Voters with ideology $y \leq Y_1^U$ and $y > Y_2^U$, however, have strictly positive payoff gains from moving from the babbling equilibrium to the informative equilibrium in the public game with unawareness but are equally well-off in the babbling equilibrium and the informative equilibrium in the microtargeting game with unawareness (see Propositions 2 and 3 and equations (A.12), (A.14)-(A.16)).

Thus, all voters have a weakly higher payoff and some voters have a strictly higher

payoff in the public games than in the microtargeting games and, consequently, total welfare is strictly higher in the public games than in the microtargeting games (3).

(2) Let us first look at the gain in expected payoffs for voter y from moving from the public game with voter unawareness to the public game with voter awareness. Without loss of generality, we consider the case that voter y receives message $m = -1$.

Consider first an interest group with ideology $\hat{z}(\theta = 1) < z \leq \hat{z}(\theta = -1)$. The gain for voter y is given in equations (A.13)-(A.17), with the exception that we need to substitute p by $\mu * (m = -1)$ (21) and $\mu(m = -1)$ by $\mu = 1$ (19).

Consider now an interest group with ideology $z \leq \hat{z}(\theta = 1)$ or $z > \hat{z}(\theta = -1)$. The gain is as follows for a voter with ideology $y \leq \min\{x_L, \hat{y}_{\{p\}}\}$, with $\mu(m = -1)$ given in (21):

$$\begin{aligned} & \frac{\mathbb{E}[U(a = L, y, \theta) | p] - \mathbb{E}[U(a = L, y, \theta) | \mu(m = -1)]}{\bar{c}} \\ & \times \left(\mathbb{E}[U(a = L, y, \theta) | \mu(m = -1)] \right. \\ & \left. - \int_{\mathbb{E}[U(a=L,y,\theta)|\mu(m=-1)]}^{\mathbb{E}[U(a=L,y,\theta)|p]} \frac{c_y}{\mathbb{E}[U(a = L, y, \theta) | p] - \mathbb{E}[U(a = L, y, \theta) | \mu(m = -1)]} dc_y \right), \quad (\text{A.20}) \end{aligned}$$

which is strictly positive because $\mu(m = -1) > p$ and $U(a = L, y, \theta = -1) < U(a = L, y, \theta = 1)$ for $y \leq \min\{x_L, \hat{y}_{\{p\}}\}$.

The gain from news is as follows for a voter with ideology $x_L < y < \hat{y}_{\{p\}}$:

$$\begin{aligned} & \frac{\mathbb{E}[U(a = L, y, \theta) | \mu(m = -1)] - \mathbb{E}[U(a = L, y, \theta) | p]}{\bar{c}} \\ & \times \left(\int_{\mathbb{E}[U(a=L,y)|p]}^{\mathbb{E}[U(a=L,y,\theta)|\mu(m=-1)]} \frac{c_y}{\mathbb{E}[U(a = L, y, \theta) | \mu(m = -1)] - \mathbb{E}[U(a = L, y) | p]} dc_y \right. \\ & \left. - \mathbb{E}[U(a = L, y, \theta) | \mu(m = -1)] \right), \quad (\text{A.21}) \end{aligned}$$

which is strictly positive because $\mu(m = -1) > p$ and $U(a = L, y, \theta = -1) > U(a = L, y, \theta = 1)$ for $x_L < y < \hat{y}_{\{p\}}$.

The gain is as follows for a voter with ideology $\hat{y}_{\{p\}} < y \leq \hat{y}_{\{\mu_2\}}$:

$$\begin{aligned} & \frac{\mathbb{E}[U(a=R, y, \theta) | p]}{\bar{c}} \left(\mathbb{E}[U(a=R, y, \theta) | \mu(m=-1)] - \right. \\ & \left. \int_0^{\mathbb{E}[U(a=R, y, \theta) | p]} \frac{c_y}{\mathbb{E}[U(a=R, y, \theta) | p]} dc_y \right) \\ & - \frac{\mathbb{E}[U(a=L, y, \theta) | \mu(m=-1)]}{\bar{c}} \left(\mathbb{E}[U(a=L, y, \theta) | \mu(m=-1)] \right. \\ & \left. - \int_0^{\mathbb{E}[U(a=L, y, \theta) | \mu(m=-1)]} \frac{c_y}{\mathbb{E}[U(a=L, y, \theta) | \mu(m=-1)]} dc_y \right), \end{aligned} \quad (\text{A.22})$$

which is strictly positive because $\mu(m=-1) > p$ and $U(a=L, y, \theta=-1) > U(a=R, y, \theta=-1)$ for $\hat{y}_{\{p\}} < y \leq \hat{y}_{\{\mu_2\}}$.

The gain is as follows for a voter with ideology $\hat{y}_{\{\mu_2\}} < y < x_R$:

$$\begin{aligned} & \frac{\mathbb{E}[U(a=R, y, \theta) | p] - \mathbb{E}[U(a=R, y, \theta) | \mu(m=-1)]}{\bar{c}} \\ & \times \left(\mathbb{E}[U(a=R, y, \theta) | \mu(m=-1)] \right. \\ & \left. - \int_{\mathbb{E}[U(a=R, y, \theta) | \mu(m=-1)]}^{\mathbb{E}[U(a=R, y, \theta) | p]} \frac{c_y}{\mathbb{E}[U(a=R, y, \theta) | p] - \mathbb{E}[U(a=R, y, \theta) | \mu(m=-1)]} dc_y \right), \end{aligned} \quad (\text{A.23})$$

which is strictly positive because $\mu(m=-1) > p$ and $U(a=R, y, \theta=-1) < U(a=R, y, \theta=1)$ for $\hat{y}_{\{\mu_2\}} < y < x_R$.

The gain is as follows for a voter with ideology $y > \max\{x_R, \hat{y}_{\{\mu_2\}}\}$:

$$\begin{aligned} & \frac{\mathbb{E}[U(a=R, y, \theta) | \mu(m=-1)] - \mathbb{E}[U(a=R, y, \theta) | p]}{\bar{c}} \\ & \times \left(\int_{\mathbb{E}[U(a=R, y, \theta) | p]}^{\mathbb{E}[U(a=R, y, \theta) | \mu(m=-1)]} \frac{c_y}{\mathbb{E}[U(a=R, y, \theta) | \mu(m=-1)] - \mathbb{E}[U(a=R, y, \theta) | p]} dc_y \right. \\ & \left. - \mathbb{E}[U(a=R, y, \theta) | \mu(m=-1)] \right), \end{aligned} \quad (\text{A.24})$$

which is strictly positive because $\mu(m=-1) > p$ and $U(a=R, y, \theta=-1) > U(a=R, y, \theta=1)$ for $y > \max\{x_R, \hat{y}_{\{\mu_2\}}\}$.

Thus, the gain is strictly positive for each voter y and any interest group ideology z and, consequently, total voter welfare is strictly higher in the public game with voter awareness than in the public game with voter unawareness (3).

Let us now look at the gain in expected payoffs for voter y from moving from the microtargeting game with voter unawareness to the microtargeting game with voter awareness.

Consider first stable moderate voters (with ideology $Y_1^U < y \leq Y_2^U$). For them, the gain from awareness is exactly the same as in the public games (see above).

Consider now the unstable moderate voters (with ideology $Y_1^A < y \leq Y_1^U$ or $Y_2^U < y \leq Y_2^A$). For them, the gain from awareness is given in equations (A.13) and (A.17), with $\mu(m = -1) = 1$ if $\hat{z}(\theta = 1) < z \leq \hat{z}(\theta = -1)$ (27). If $z \leq \hat{z}(\theta = 1)$ or $z > \hat{z}(\theta = -1)$, unstable moderate voters hold the same beliefs (equations (21) and (27)) and have, consequently, the same payoffs in both microtargeting games.

Lastly, consider the stable radical voters (with ideology $y \leq Y_1^A$ or $y > Y_2^A$). They hold the same beliefs for any z (equations (21) and (27)) and are, hence, equally well-off in both microtargeting games.

Thus, the gain from awareness in the microtargeting games is (weakly) positive for all voters and strictly positive for some voters. Consequently, total voter welfare is strictly higher in the microtargeting game with voter awareness than in the microtargeting game with voter unawareness.

□

Proof of Corollary 1

Proof. The welfare ranking follows directly from Proposition 5.

□

Proof of Proposition 6

Lemma A.2. *Under Assumption 4, (i) $\mathbb{E}[\tau_L|\mu = 1] > \mathbb{E}[\tau_R|\mu = 1]$ and (ii) $\mathbb{E}[\tau_R|\mu = 0] > \mathbb{E}[\tau_L|\mu = 0]$.*

Proof of Lemma A.2. (i) Using equations (2), (12), and (13), we find that $\mathbb{E}[\tau_L|\mu = 1] > \mathbb{E}[\tau_R|\mu = 1]$ if the following inequality holds:

$$g(x_L + x_R + 2) - \frac{1}{3}t[(x_L + b + 1)^3 + (x_R - b + 1)^3] > 0. \quad (\text{A.25})$$

The left-hand side of equation (A.25) is increasing in x_L and x_R under Assumptions 1 and 2. Hence, inequality (A.25) is the least likely to be fulfilled if we plug in the smallest possible values of x_L and x_R that do not violate Assumption 1. This yields the following

inequality:

$$8b^3 + 24b > 12b^2 + 16, \quad (\text{A.26})$$

which always holds under Assumption 1.

(ii) Using equations (2), (12), and (13), we find that $\mathbb{E}[\tau_R|\mu = 0] > \mathbb{E}[\tau_L|\mu = 0]$ if the following inequality holds:

$$g(2 - x_L - x_R) + \frac{1}{3}t[(x_R - b - 1)^3 + (x_L + b + 1)^3] > 0. \quad (\text{A.27})$$

The left-hand side of equation (A.27) is decreasing in x_L and x_R under Assumptions 1 and 2. Hence, inequality (A.27) is the least likely to be fulfilled if we plug in the largest possible values of x_L and x_R that do not violate Assumption 1. This yields the following inequality:

$$8b^3 + 24b > 12b^2 + 16, \quad (\text{A.28})$$

which always holds under Assumption 1. \square

We now consider Proposition 6.

Proof of Proposition 6. (1) Let us first consider the interest group's election flipping potential in the game with public communication and voter unawareness. Without loss of generality, we assume that $\theta = -1$.

Since $\tau_L - \tau_R$ increases in μ (Lemma A.1), Assumption 4 implies that there is a belief $\hat{\mu}(g, t, x_L, x_R, b)$ for which turnout for party L is equal to turnout for party R . Using (12) and (13) and plugging in $\hat{\mu}(g, t, x_L, x_R, b)$ for μ' , we find that $\hat{\mu}(g, t, x_L, x_R, b)$ solves the following equation:

$$\begin{aligned} 2\frac{2}{3}\hat{\mu}^3(\cdot) - 4\hat{\mu}^2(\cdot) + \left(\frac{g}{t} + 1 + b(x_R - x_L) - \frac{1}{2}(x_L^2 + x_R^2) - b^2\right)\hat{\mu}(\cdot) = \\ \frac{g}{4t}(2 - x_L - x_R) + (x_R - b - 1)^3 - (x_L + b - 1)^3. \end{aligned} \quad (\text{A.29})$$

Given that $\theta = -1$, an interest group would only have an incentive to manipulate an election by reporting $m = 1$ if $z > \hat{z}(\theta = -1)$ ((5), (15) and (20)). An attempt to flip an election is successful if $\hat{\mu}(\cdot) < \mu(m = 1) < p$. Using $\mu^*(m = 1)$ (21), setting it equal to $\hat{\mu}(\cdot)$ and solving for \hat{p}^{PU} , we find that the interest group's election flipping potential is:

$$\hat{p}^{PU} = \min\left\{\frac{(2(h + 1) - x_L - x_R)\hat{\mu}(\cdot)}{2(h + 2\hat{\mu}(\cdot) - 1) - x_L - x_R}, 1\right\}, \quad (\text{A.30})$$

which is strictly greater than $\hat{\mu}(\cdot)$ under Assumption 3. Hence, there is a range of prior beliefs $p \in (\hat{\mu}(\cdot), \hat{p}^{PU})$ for which the interest group can flip the election outcome with

disinformation in the game with public communication and voter unawareness.

We now set out to show that $\hat{p}^{MU} \geq \hat{p}^{PU}$. For now, we suppose that $\hat{p}^{PU} < 1$. Using Lemma A.1 and equations (5), (15), (20) and (21), we find the following inequality:

$$\frac{d(\mathbb{E}[\tau_R^{PU}|m^*(z, \theta), z > \hat{z}(\theta = -1)] - \mathbb{E}[\tau_L^{PU}|m^*(z, \theta), z > \hat{z}(\theta = -1)])}{dp} < 0. \quad (\text{A.31})$$

Given that $\hat{p}^{PU} < 1$, the following equality holds by definition:

$$\mathbb{E}[\tau_R^{PU}|m^*(z, \theta), z > \hat{z}(\theta = -1), p = \hat{p}^{PU}] = \mathbb{E}[\tau_L^{PU}|m^*(z, \theta), z > \hat{z}(\theta = -1), p = \hat{p}^{PU}]. \quad (\text{A.32})$$

Using Lemma A.2, we find that the following inequalities hold for any p :

$$\mathbb{E}[\tau_R^{MU}|m^*(z, \theta), z > \hat{z}(\theta = -1), p = \hat{p}^{PU}] > \mathbb{E}[\tau_R^{PU}|m^*(z, \theta), z > \hat{z}(\theta = -1), p = \hat{p}^{PU}], \quad (\text{A.33})$$

and

$$\mathbb{E}[\tau_L^{MU}|m^*(z, \theta), z > \hat{z}(\theta = -1), p = \hat{p}^{PU}] < \mathbb{E}[\tau_L^{PU}|m^*(z, \theta), z > \hat{z}(\theta = -1), p = \hat{p}^{PU}]. \quad (\text{A.34})$$

Hence, it follows from (A.33) and (A.34) that this inequality holds:

$$\mathbb{E}[\tau_R^{MU}|m^*(z, \theta), z > \hat{z}(\theta = -1), p = \hat{p}^{PU}] - \mathbb{E}[\tau_L^{MU}|m^*(z, \theta), z > \hat{z}(\theta = -1), p = \hat{p}^{PU}] > 0, \quad (\text{A.35})$$

which implies that $\hat{p}^{MU} > \hat{p}^{PU}$ if $\hat{p}^{PU} < 1$

If, instead, $\hat{p}^{PU} = 1$, it must be that $\hat{p}^{PU} = \hat{p}^{MU} = 1$, as \hat{p}^{PU} and \hat{p}^{MU} cannot be greater than 1.

(2) Given Assumption 4, only an interest group with ideology $z > \hat{z}(\theta = -1)$ or $z \leq \hat{z}(\theta = 1)$ might have an incentive to flip an election (see (5) and (15)). With voter unawareness, voters hold on to their prior belief p when they receive news from this interest group type (Propositions 1 and 4). Hence, following Definition 1, election flipping cannot occur. □

Proof of Proposition 7

Proof. Consider first the VWMPBE of the public game with voter unawareness. Using (20) and applying Bayes' rule, voters' posterior belief is given in equ. (29). Since (29) increases in q (the number of messages $m = -1$) and decreases in s (the number of messages $m = 1$), an interest group has no incentive to deviate from its reporting behavior, regardless of the

number of other interest groups. Using (7), a voter maximizes her expected utility by voting for party j if $c_y < \mathbb{E}[U(a = j, y, \theta) | \mu^*(\cdot)]$, where $\mu^*(\cdot)$ is formed by Bayesian updating. Hence, a voter *only* maximizes her expected utility if she has the posterior belief given in (29), which is the result of Bayesian updating and which takes *all* news items into account. It then follows that voter welfare increases with interest group competition (3).

The proof for the microtargeting game with voter unawareness is the same, with the exception that only moderate voters receive informative news and experience an increase in the expected payoff from voting due to interest group competition.

In the proofs of Proposition 1 and Proposition 4, we have established that (moderate) voters only have a higher payoff in the informative equilibrium than in the babbling equilibrium if they face a moderate interest group. Using (15), we find that the expected number of moderate interest groups that a voter encounters is equal to K/h , which is increasing in K . Thus, all voters have a (weakly) higher payoff due to interest group competition in games with voter awareness. It then follows that voter welfare increases with interest group competition (3). \square